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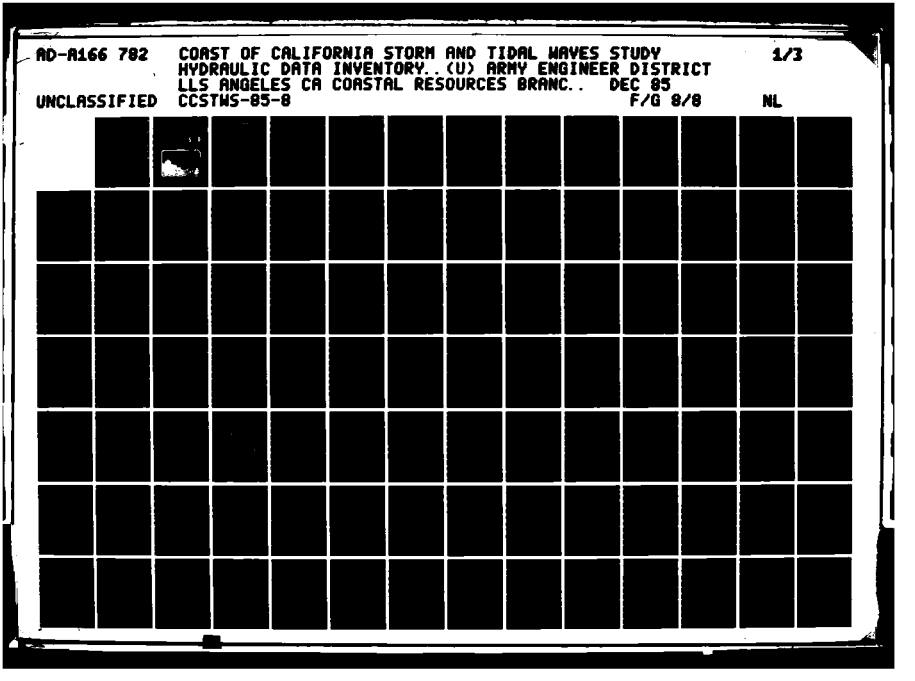

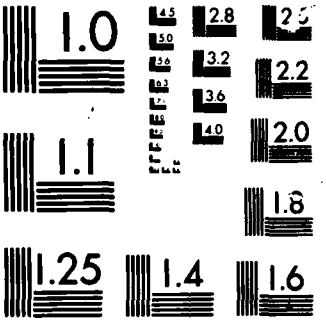

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US Army Corps
of Engineers
Los Angeles District

COAST OF CALIFORNIA
STORM AND TIDAL WAVES STUDY

HYDROLOGIC DATA INVENTORY

SOUTHERN CALIFORNIA COASTAL ZONE

CCSTWS 85-8
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THIS REPORT DETAILS THE RESULTS OF A DATA SEARCH ON THE HYDROLOGY OF THE COASTAL WATERSHED BETWEEN RAGGED POINT, SAN LUIS OBISPO COUNTY AND THE US MEXICAN BORDER. THIS STUDY IS PART OF THE COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY CURRENTLY BEING CONDUCTED BY THE US ARMY CORP OF ENGINEERS.

THE LITERATURE SURVEY AND DATA SEARCH WERE DIRECTED TOWARDS:

(1) CONTINUOUS STREAMFLOW HISTORY AT THE SHORELINE TERMINUS OF WATERCOURSES FOR ALL STREAMS

(2) VOLUME - FREQUENCY ANALYSIS FOR VARIOUS STREAMS AT THE SHORELINE

TERMINUS.

(3) HISTORIC HYDROGAPHS FOR MAJOR FLOOD EVENTS WITHIN THE STUDY AREA

(4) AVERAGE ANNUAL SEDIMENT YIEDD QUANTIFICAITON AND SEDIMENT GRAIN SIZE DISTRIBUTION FOR VARIOUS STREAMS AT SHORELINE TERMINUS

(5) FLOOD CONTROL AND WATER CONSERVATION FACILITIES (DAMS, ETC.) ON EROSION AND SEDIMENTATION CHARACTERISTICS OF THE MAJOR RECEIVING STREAMS

(6) FOREST FIRE EFFECTS ON SEDIMENT YIELD AND PEAK SEDIMENT DISCHARGES FOR ALL WATERSHEDS WITHIN EACH LITTORAL CELL.

THE DATA SEARCH WAS DIRECTED TOWARDS IDENTIFYING AND COLLECTING RELEVANT HISTORICAL FLOOD AND EROSIONAL DATA, AS WELL AS HISTORY OF FOREST FIRES, WITHIN EACH LITTORAL CELL.

HYDROLOGIC DATA INVENTORY
SOUTHERN CALIFORNIA COASTAL ZONE
RAGGED POINT (SAN LUIS OBISPO COUNTY) TO MEXICAN BORDER
Ref. No. CCSTWS 85-8

Coast of California Storm and Tidal Waves Study

U.S. Army Corps of Engineers
Los Angeles District, Planning Division
Coastal Resources Branch
P.O. Box 2711
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prepared by

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1.0 INTRODUCTION

A. Purpose of the Study

This report details the results of a data search on the hydrology of the coastal watersheds between Ragged Point, San Luis Obispo County and the U.S. - Mexican Border. This study is part of the Coast of California Storm and Tidal Waves Study currently being conducted by the U.S. Army Corps of Engineers.

The results of this study can be used to develop detailed plans of study for the three coastal regions within the jurisdiction of the Corps of Engineers, Los Angeles District. These are the South Central Region, which includes San Luis Obispo, Santa Barbara and Ventura counties; the South Coast Region, which includes Los Angeles, San Bernardino, Riverside, and Orange Counties; and the San Diego Region, which includes portions of San Diego, Riverside and Orange Counties.

Included in this report are general hydrological descriptions of the drainage areas, in order to provide background information. These sections are followed by detailed accounts of the sources of hydrologic data which are available. Data of interest include streamflow history at the shoreline of streams and stream groups, volume-frequency analyses, historic hydrographs of major floods, sediment yield, effects of various structures and fire effects. Included in the discussion are the location of data, data formats available and indications of the quality of the data.

Data gaps and limitations are noted, and recommendations are presented for reducing these limitations.

This study will allow a serious start towards the development of the necessary data base for the Coast of California Storm and Tidal Wave Study (CCSTWS), since all pertinent available data are identified, and the means recorded for retrieving these data.

B. Scope of the Study

This study was conducted under Contract No. DACW09-85-D-0010, Delivery Order No. 0001, U.S. Army Corps of Engineers, Los Angeles District. The scope includes a hydrologic literature survey and data search for the South Central, South Coast and San Diego regions. The literature survey and data search were directed towards:

(1) Continuous streamflow history at the shoreline terminus of watercourses for all streams or stream groups.

(2) Volume-frequency analysis for various streams at the shoreline terminus.

(3) Historic hydrographs for major flood events within the study area.

(4) Quantification of average annual sediment yield and its grain size distribution for various streams at the shoreline terminus.

(5) The impact of existing dams, reservoirs, debris basins, gravel mining operations, and other flood control and water conservation facilities on the erosion and sedimentation characteristics of the major receiving streams.

(6) The effects of forest fires on the peak discharges and sediment yield values for all watersheds within each littoral cell.

The data search was directed towards identifying and collecting relevant historical flood and erosion data, as well as history of forest fires, within each littoral cell. An annotated bibliography, submitted under a separate cover, is also included in this study.

C. Summary of Findings

Pertinent hydrologic conditions and the available data related to these conditions were examined. The following gives a summary of the finding by region.

C.1 San Diego Region

Over fifty percent of the watershed area in this region is controlled by major dams, most of which are for water-supply. A significant number of small streams terminate in coastal marshes or lagoons, which reduces their effects on coastal sediment delivery.

Most major streams have been gauged for more than sixty years, so that reliable long term stream measurements are available. In addition sediment measurements have been made in many of the major streams from 1968 to 1978; in a few case, these measurements are continuing. Estimates have been made of the long term actual and natural sediment yield from major streams (Brownlie, 1981). This region is well covered in this respect.

Forest fire data are available in this region, but fire-area-frequency studies need to be made. In addition, there are several studies which have produced annual peak-flow frequency studies, but annual volume-frequency studies should also be made for the major streams.

C.2 South Coast Region

This region is heavily urbanized and over sixty percent of the watershed area is controlled by flood control dams.

The major streams in this region have been gauged for over fifty years, and reliable long term measurements are available. However, except for the Santa Ana River, few data are available on sediment transport in the streams of this region. Because data are available on sediment accumulation in debris basins and reservoirs reliable estimates of natural and actual transport of sediment could be made if reliable sediment measurements were made in selected streams in this region.

Forest fire data are available, but fire-area-frequency studies need to be made. In addition, annual volume-frequency studies should be made for the streams in this region. Except for sediment measurements in streams, there is a tremendous amount of data available in this region, and a significant amount of progress can be made using these data.

C.3 South Central Region

This region is the least controlled of the three, with approximately thirty-six percent of the watershed area controlled by water-supply reservoirs.

The region is largely rural, with a large portion consisting of undeveloped forest.

Except for the major streams in Ventura County, there are few sediment data in this region. Most major streams have been gauged for more than forty years, but in many cases, the length of record prior to the construction of dams is short. More sediment measurements are needed in streams in Santa Barbara and San Luis Obispo Counties, particularly the Santa Ynez River, the Santa Maria River, and north of Morro Bay.

Extensive forest fire frequency studies (which include such items as the age of brush) have been made at the Los Padres National Forest. Annual volume-frequency studies for streams are needed. Without additional data on the present sediment yield of streams in this region, little can be said of the effect of control structures or urbanization.

2.0 SAN DIEGO REGION

The San Diego Region includes portions of Orange, Riverside and San Diego Counties. The extent of the San Diego Region is defined by the watersheds draining to the Oceanside Cell, which extends from Dana Point to Point La Jolla; the South Oceanside Reach, which includes the short distance between Point La Jolla and False Point; the Mission Bay Cell, which extends from False Point to the Sunset Cliffs; the South Mission Bay Reach, which includes the Sunset Cliffs; and the Silver Strand Cell, which extends the from the mouth of San Diego Bay to just south of the mouth of the Tijuana River. Of these areas, the watersheds draining to the Oceanside Cell are the most important from a sediment transport point of view, for reasons which will become apparent in the following discussions. These littoral cells correspond to those defined in the Assessment and Atlas of Shoreline Erosion Along the California Coast (July 1977) and are shown in Figure 2.1, taken from that document. The following sections give general hydrologic information regarding the watersheds draining into these subregions.

A. Drainage Areas

A.1 Drainage areas and Sub-areas

In the San Diego Region there are seven major river basins and four major drainage groups. The river basins drain to the Tijuana River, the Otay River, the Sweetwater River, the San Diego River, the San Luis Rey River, and the Santa Margarita River. The major drainage groups are the San Diego Group, the San Clemente Canyon Group, the Escondido Creek Group and the Laguna Hills group. These watershed areas are indicated on Plate 2.1 and their respective surface areas are shown in Table 2.1.

As is seen in Table 2.1, the river basins are substantially controlled, largely by water-supply reservoirs. This is particularly true of the more southern basins, which have from 70% to 90% of their surface areas controlled. The reservoirs retain most coarse-grained sediment which enters, and thus severely limit the quantity of sediment arriving at the coast.

The Laguna Hills Group drains from the southern end of the Santa Ana Mountains and the Santa Margarita Mountains. The major sub-areas in this group include the San Juan Creek - Arroyo Trabuco basin, the San Mateo Creek basin, and the San Onofre Creek basin.

The Santa Margarita River Basin drains an area bordering the southern portion of the confined Lake Elsinore basin. This basin is controlled by three major reservoirs: Vail Lake, Lake Skinner and Lake O'Neill, with Vail Lake being the important control as far as basin drainage area is concerned. Major sub-areas include the Temecula Creek sub-basin, which includes Vail Lake and Murietta Creek - Tucalota Creek sub-basin.

The San Luis Rey River Basin drains a portion of the Peninsular Ranges south of the Santa Margarita River Basin. A large portion of the basin (37%) drains to Lake Henshaw, a water-supply reservoir and the major control structure in the basin. Control structures of lesser importance include Guajome, Windmill and Whelan Lakes, which are considered to have only a minor effect on the sediment yield of the basin (Brownlie, 1981). The major sub-basins include the Lake Henshaw sub-basin, and the coastal sub-basin.

The Escondido Creek Group drains a relatively small coastal area south of the San Luis Rey River. The major drainage basins in this group include Buena Vista Creek, which drains to Buena Vista Lagoon, Agua Hedionda Creek, which drains to Agua Hedionda Lagoon, and Escondido Creek, which drains to the San Elijo Lagoon. The major control structure in the group is Lake Wohlford, a water storage facility.

The San Dieguito River Basin drains a portion of the Peninsular Ranges south of the Escondido Creek Group and the San Luis Rey River Basin. There are two major control facilities, Lake Hodges and Sutherland Reservoir, which control 88% of the basin. The major sub-basins include the uncontrolled coastal region and the Santa Ysabel Creek sub-basin above Lake Hodges.

South of the San Dieguito River Basin lies the coastal San Clemente Canyon Group, a portion of which drains to the Oceanside Cell. The major drainage basins in this group are the Los Peñasquitos Creek Basin, which drains to Los Peñasquitos Lagoon and the San Clemente - Rose Canyon area which drains to Mission Bay. Much of the coastal area in this group is heavily urbanized.

The San Diego River Basin also drains portions of the Peninsular Ranges. Sixty percent of the drainage basin is controlled by two major water-supply reservoirs: El Capitan Reservoir on the San Diego River and San Vicente Reservoir on San Vicente Creek. Major sub-basins include the San Vicente Creek sub-basin, the sub-basin above El Capitan Dam and the lower coastal sub-basin. The San Diego River drains to the Pacific Ocean just south of Mission Bay.

Three small basins drain to San Diego Bay, and these have little effect on coastal sediment delivery. These basins are the San Diego Group, which is heavily urbanized, and the Sweetwater River and Otay River basins, which are urbanized in the lower reaches and heavily controlled in the upper reaches. Control facilities include Sweetwater Reservoir and Loveland Reservoir on the Sweetwater River and the Lower Otay Reservoir on the Otay River.

The Tijuana River drains a large area, most of which is in Mexico, to the Silver Strand Cell. The drainage basin is made up of two sub-basins: the Cottonwood-Tecate Creek basins and the Rio de las Palmas basin. Major control facilities include Rodriguez Reservoir on Rio de las Palmas, and Morena and Barrett Reservoirs on Cottonwood Creek.

A.2 Physiography and Topography

The watersheds draining to the San Diego Coast Region are bounded on the east by the Peninsular Ranges and on the north by the southern end of the Santa Ana and San Jacinto Mountains. The Peninsular Ranges run southward and have a complex topography consisting of valleys and canyons with more or less isolated mountains. Table 2.2 summarizes the main characteristics of the major basins in the region. The following discussion gives some general features of the area.

The Laguna Hills Group drains an area including the southern end of the Santa Ana Mountains. The San Juan - Arroyo Trabuco basin and the San Mateo Creek basin, the two largest basins in the group, rise from sea level to elevations of 4500 feet and 3500 feet, respectively. Their average slopes are on the order of 0.016. The lower portion is composed of hilly terrain, and the coastal area is urbanized.

The Santa Margarita River basin varies greatly in elevation, with a maximum elevation over 6000 feet. Unlike the southern rivers, the Santa Margarita River has a rather gentle slope over its entire reach, varying from about 0.002 near the coast to 0.005 in the upper reaches. The mouth of the river drains to a coastal saltmarsh. Five percent of the basin is urbanized and twenty-six percent is agriculturally developed.

The San Luis Rey River basin also has varied topography, rising to more than 6000 feet at Mt. Palomar. The river has a gentle slope of about 0.003 in the coastal plains, but rises abruptly in the upper reaches, where the slope is over 0.055.

The Escondido Creek group covers a small area near the coast, with maximum elevation around 2000 feet. The major streams in this group terminate in lagoons or salt marshes, and thus have a limited effect on sediment transport to the coast.

The San Dieguito River basin has varied topography, with low coastal terraces in the western and central portions. The maximum elevation in the basin is over 5700 feet (Vulcan Mountain). The river bed slope is gentle in the lower 15 miles (0.003) below Lake Hodges.

The San Diego River basin has an average elevation of about 1500 feet, and rises abruptly in the eastern end to over 5500 feet. The lower 30 miles of the river crosses a coastal plains area with an average slope of about 0.004.

The Sweetwater River flows mainly through narrow valleys, with relatively flat coastal plains downstream. The highest elevation is 6500 feet in the Cuyamaca Mountains.

Most of the Tijuana River basin lies in Mexico, and the eastern and central portions lie in the Peninsular Range region. The lower 50 miles of the river reach have an average slope of approximately 0.004.

A.3 San Diego Region Climate

The San Diego Region is classified as belonging to the Mediterranean Dry Summer Subtropical climatic type. Along the maritime fringe, temperatures are controlled by the sea, with average winter temperatures of 55°F and average summer temperatures of about 70°F. Inland temperatures vary much more, with freezing temperatures not uncommon in winter in the mountains, and summer temperatures often above 90°F except at the higher elevations.

Reliable, long term rainfall records are available for this region. Table 2.3 shows the mean annual rainfall, along with measured extremes, for selected stations in the region. As can be seen in Table 2.3, the year-to-year variation in rainfall can be extreme, with maximum values generally more than twice the mean, and minimum values usually one-third the mean. There is a tendency towards decreasing mean precipitation toward the south, and there is a strong orographic effect. Typically, mean annual precipitation is from 10 to 14 inches on the coast (depending on latitude and coastal topography) rising to 40 inches in the mountain peaks.

Seasonal distribution of precipitation is also pronounced, as can be seen in Table 2.4, which shows average monthly precipitation at selected stations. At the lower elevations, there is almost no precipitation in the summer months; higher elevations show a significant amount due to summer thunderstorms.

An important climatic feature of the region are the foehn, or Santa Ana, winds which can develop at any time of the year, but are most common in fall and winter, usually developing a day or so after the passage of a cold front. The adiabatic heating of the air masses as they descend from the Great Basin can cause hot, dry conditions which produce extreme fire danger. For a more complete discussion of the climate of this region, one is referred to the companion report on meteorology.

A.4 Soils and Vegetation of the San Diego Region

An excellent overview of the vegetation in this region is given by Wells and Palmer (1982), who have developed maps of both present and original vegetation patterns in the Southern California coastal region.

The San Diego Region is characterized by heavy urban development in the lowland coastal areas, with much of the mountain and inland valleys remaining relatively undeveloped. The developed areas were once grasslands or covered with coastal shrub. The inland areas remain, for the most part, covered by chaparral.

Chaparral is considered to be the most important vegetation type in the area. It is both an efficient watershed protector and slope stabilizer, and is extremely susceptible to fire. Chaparral plants are evergreen, sclerophyll shrubs with extremely strong root systems. The plants are well adapted to steep, rugged terrain, as they form deep, extensive root systems. The strong root system makes them a valued watershed protector.

However, chaparral plants are among the most flammable plants known (Wells, 1982), and have the characteristic that as much as 50 percent of their biomass may be dead after 30 years. This makes chaparral areas, particularly older areas, susceptible to fire, which denudes the steep mountain sides of their protection from erosion. Chaparral covers more than 50 percent of the San Diego Region.

The second predominant type of vegetation is the coastal sage shrub, which is similar to chaparral, but smaller and less woody. This type occurs on the coastal foothills of this region, especially on depositional areas with coarse textured soils.

Typically, natural vegetation in the watershed basins is sparse, with dense stands of trees and shrubs along water courses and northern slopes. At the very highest elevations, particularly near Palomar and Cuyamaca, one finds coniferous forests. Much of the lowlands is presently agriculturally developed. This is particularly true for the Santa Margarita River, San Luis Rey River and San Dieguito River basins, of which 25 to 30% of the land area is devoted to agriculture.

For the most part, the streams in the San Diego region flow over the crystalline rocks of the Southern California batholith. These include igneous rock of granitic composition overlying sedimentary deposits. The soils are of

recent alluvial origin in the valleys and coastal plains. The mountain areas are often steep and rugged, and susceptible to erosion. The base of the mountains and valleys are covered with coarse alluvium, while the coastal terraces are overlain by marine sediments.

Coastal marshes and lagoons are an important feature in this region. The Santa Margarita River terminates in a coastal lagoon, and during low flows a beach berm forms and encloses the lagoon. The berm is broken in high flows (as in 1969) and allows sediments to pass to the ocean (Brownlie, 1981).

The major creeks of the Escondido Creek group all end in saltmarshes or lagoons, thus limiting the importance of this watershed as far as delivery of sand to the coast is concerned (Ritter, 1972). In addition, Los Peñasquitos Lagoon traps the sediment arriving from the Soledad and Los Peñasquitos Creeks.

As mentioned previously, the Sweetwater and Otay Rivers terminate in the San Diego Bay, which drastically reduces their effect on coastal sediment (Brownlie, 1981).

A.5 Development and Structures Affecting Runoff

The northern half of the San Diego region is largely rural in character, with extensive agricultural land. As mentioned previously 25 to 30% of the Santa Margarita, San Luis Rey and San Dieguito River basins are agriculturally developed. By contrast the southwest portion of the region is heavily urbanized, with 23% of the San Diego River basin being urban, and only 3% agricultural land. Urbanization effects only a relatively small corner of the region, and much of the urban area drains to San Diego and Mission Bays, thus limiting the effect of the reduced sediment delivery caused by development.

The upland watersheds are heavily controlled, with over 50% of the region draining to major water-supply facilities. These facilities, along with sand and gravel mines, are marked on Plate 2.1 and are shown schematically on Plate 2.2. Table 2.5 lists these facilities along with some important features.

The reservoirs in the region, built for water-supply in a region of relatively low rainfall, date back to 1887. The most recent is Skinner Reservoir, which is used for water-supply, and is required to pass all inflow.

There are only a few small debris basins in this region, and these have a limited effect on sediment transport to the coast. The water-supply reservoirs, none of which has ever been cleaned out, necessarily have a large effect on coastal sediment delivery, as most are downstream of the mountain area subject to erosion. This will be seen in more quantitative terms in the next section.

A.6 Runoff and Sediment Characteristics

As might be expected from rainfall patterns in the San Diego Region (Tables 2.3 and 2.4), runoff in the streams of this region is highly variable. Table 2.6 shows some characteristics of runoff data which tend to highlight this variability, for major streams of this region. For a discussion of the runoff records available for this region, see Section C.

One must use caution in examining the data in Table 2.6, since the flow is heavily controlled in almost all the streams. The San Dieguito River, for example, has a mean annual flow of 17 cfs, which represents releases from Lake Hodges. Typically, however, the peak recorded flows are on the order of 1000 or more times the average flow. Minimum flows are zero in all cases. There is strong year-to-year variability as well, with many years as high as three times the average and other years nearly zero. Typical discharge hydrographs for the major streams in this region are presented in Appendix A.

Sediment data have only been collected since 1967, and many of the data programs stopped in 1978. Therefore, the sediment data shown in Table 2.6 reflect a short period with some high rainfall and runoff events (1969,1978), and several drought years (1975-1977). The average annual sediment delivery estimates were made by Brownlie (1981). The one outstanding feature is the 1969 delivery of the Santa Margarita River, a measured 534,000 tons in one day. It was during this flood that the berm at the terminus of the river was broken. In most other cases, the maximum measured one-day delivery is on the order of the average annual delivery.

Sediment size distribution data, especially for bed material, is given by Brownlie (1981), and can be found in U.S.G.S. water quality data publications. In general, the data indicate that the median grain size is form 0.01" to 0.014" (0.25 to 0.35mm) for bed material, with somewhat finer suspended material. Typical grain size distribution date are presented in Appendix A.

A.7 Forest Fires in the San Diego Region

As in all of Southern California, forest fires are of great importance to erosional processes in the San Diego Region. Fire maps of the region, compiled by Sayer et al. (1981) are being submitted under a separate cover. A glance at the maps reveals the fact that most fires, and especially the major fires, occur in the chaparral areas. (A detailed evaluation is possible with an examination of the vegetation and fire maps provided with the Caltech EQL Report 17-D.) The coastal urban and agricultural areas, as well as inland agricultural areas surround large "islands" of burned over chaparral areas.

In some areas, such as the inland watersheds of the San Diego and Sweetwater Rivers, large burns have occurred in this century, but these probably had little effect on sediment delivery to the coast because of the numerous water-supply reservoirs between the upland watersheds and the coast. However, in the more northern areas, burns in chaparral areas in the coastal hills above the Laguna Hills Group and the Santa Margarita River have certainly affected coastal sediment delivery.

By way of example, Brownlie (1981) used sediment discharge measurements in the Santa Margarita river to develop a sediment discharge curve (Figure 2.2). In August, 1969, several fires burned portions of the Santa Margarita Watershed. The following winter, rains were light, but in March a flow occurred which, according to Brownlie's curve, should have produced 1500 tons/day of sediment at the coast, but 6000 tons were measured that day. In most watershed areas of the San Diego Region, forest fires do not necessarily mean that the beaches will be supplied with large amounts of sand because of upstream reservoirs.

B. Historical Perspective

B.1 Historical Outline of Floods and Erosional Events

Flood history in the San Diego Region goes back to the early Nineteenth Century, but quantitative data are unavailable until the turn of the century. Early floods were reported in 1825, 1862, 1884, 1891. More recent floods, shown with peak discharges, are presented in Table 2.7. Note that the 1916 flood is more representative of the flood potential, since the more recent floods are influenced by extensive controls.

The flood of 1862 was particularly devastating. Mission Valley was covered by deep water; large boats able to withstand the current could sail well up the valley. All ranches and structures in the valley were destroyed (Kuhn and Shepard, 1981). The 1884 floods destroyed many bridges and several miles of railroad track; rail communications were cutoff for nine months (Kuhn and Shepard, 1981). The 1916 flood caused much damage, much of it due to dam failures.

Details on erosional events is much less precise, since it is only recently that sediment measurements have been kept. The 1862 floods left many sand bars in San Diego Bay, and there were severe debris flows in 1884 (Kuhn and Shepard, 1981). During the 1969 flood, the berm at the mouth of the Santa Margarita River was swept away. Brownlie (1981) estimated that 29% of the sediment carried to the coast by the Santa Margarita River since 1931 was delivered during the 1969 floods, and that the 1938 and 1969 floods combined accounted for over 50% of the sediment delivery.

B.2 Forest fire history, San Diego Region

The most complete history of forest fires in this region is that compiled by Wells and Brown (1982). Copies of the decade fire maps, compiled by Sayer et al. (1981) are being submitted under a separate cover. Table 2.8 outlines the history of major fires in the region since 1910.

A study by Byrne (1979) in the Santa Barbara region indicated that there was a 30 to 35 year burn cycle in the Santa Ynez mountain area, dating back to the Eighth Century. This trend can be seen in Table 2.8 as well. Major burns occurred in the Tijuana River (Cottonwood Creek) watershed in the 1943-1944 period and again in 1970. The Santa Margarita River watershed had major burns in 1928 and again in 1969. This cycle probably reflects the age of the chaparral, which becomes extremely susceptible to fire after 30 years.

The more recent fires all apparently started during Santa Ana conditions, as can be seen from the dates of the fires. This again points out the extreme danger of Santa Ana conditions, and their importance in fire-flood sequences.

C. Data Search and Retrieval Efforts

C.1 Technical Approach

Data were collected from a number of governmental and public organizations. Previous reports and documents on similar topics were located and examined as part of the literature search. These documents often contained or referred to data, whose original sources were noted. An important source during the initial stages were the notes and documents collected by Brent Taylor during the Sediment Management project at the Environmental Quality Laboratory (EQL), Caltech. Government and public agencies were then contacted, and in many cases visited. The following is a general description of data sources relevant to the South Coast Region.

San Diego County Flood Control District

Relevant data include:

Precipitation data, with hourly and charts available in hardcopy.
Streamflow data--daily and selected hydrographs on hardcopy.
Storm reports are available for selected recent storms.
No sediment, debris or fire records are kept.
People contacted include:
Carey Stevenson (Hydrology) (619) 565-5821

Orange County Environmental Management Agency

The data sources at this agency include:

Precipitation data with both hourly (tabulated) and charts from recording gages;
Streamflow data, with both daily (tabulated) and charts from recording gages;
Debris data are limited, but a new program on the San Diego Creek is starting;
Sediment data are collected in conjunction with the U.S.G.S.
In a new program just starting, the agency will collect its own data. The sediment data are on a computer data base.
The most recent publication covers the 1982-1983 season.
People contacted include:
Emmett Franklin (streamflow, precipitation)
(714) 634-7473
Bob Collicott (sediment, water quality) (714) 634-7463
Tom Rossmiller, Bruce Moore (sediment, water quality)
Dale Dillon (debris, channel cleanouts) (714) 634-7424

Riverside County Flood Control and Water Conservation District

Relevant data at this agency include:

Precipitation data, with both hourly (tabulated) and charts from recording gages available. In addition, most data are on a computer data base and are available in printouts and electronic form.
Debris and sedimentation data are limited, since the county has few debris basins.
The most recent publication covers the 1979-81 seasons.
People contacted include:
Kathy Carter (Hydrology) (714) 787-1264
Tom Clem (Hydrology) (714) 787-1264
Eric Geibersen (Dams, debris basins) (714) 787-2015

U.S. Marine Corps, Camp Pendleton

The Department of Natural Resources at this base maintains stream gages of interest on the San Mateo and San Onofre Creeks. Data can be obtained with a written request to:

Commanding General
U.S. Marine Corps Base, Camp Pendleton
Attn: Director of Natural Resources
Camp Pendleton, CA 92055

People contacted include:
Ms. Dawn Lawson (619) 725-4512

U.S. Geological Survey

Data available from this agency include:

Streamflow, with daily and monthly flows, peak flows and storm hydrographs available.
Sediment, with data available in published reports. Unpublished data are also available at the Laguna Niguel office.
Data are in reports (Water-Supply Papers and, more recently, Water Resources Data) and in electronic form at the Sacramento District Office, where a data base, WATSTORE, is maintained.
People contacted include:
Chris McConaughy (Laguna Niguel Office) (714) 643-4232
John Beck (Sacramento Office, Water Resources Data)
(916) 484-4830

U.S. Forest Service

Data available from this agency include:

Fire history with fire maps available for fires in the National Forests; Sedimentation and erosion data from the San Dimas Experimental Forest. These data include pre- and post-fire runoff measurements from both natural and controlled burns, water repellency data, vegetation and soils information. For information in this area, contact the Pacific Southwest Forest and Range Experiment Station, Riverside.

People contacted include:
Wade Wells (714) 351-6515, PSWF&R
Charles Colver (818) 684-0350, San Dimas Experimental Forest
Carol Keniflit (714) 351-6555, PSWF&R

California Department of Water Resources

Data from this agency include:

Streamflow, with data available in the Water Data Information System (WDIS). Data are available on microfiche (least expensive) and electronic form.
Precipitation, also available on WDIS.
People contacted include:
Bill Mork, State Climatologist (916) 445-5800

Environmental Quality Laboratory, California Institute of Technology

Data from the sediment management project are archived. Data readily available include maps of vegetation cover, debris basins, and fire history.

People contacted include:
Dr. Robert C. Y. Koh (Keck Laboratory) (818) 356-4400
Prof. Norman H. Brooks (presently on sabbatical leave)
Theresa Fall (EQL) (818) 356-6420

Other individuals contacted include:

Gerald Kuhn, Scripps Institution of Oceanography, Coastal History (619) 452-4856

There are several reference libraries in the South Coast Region which are extremely helpful. These include:

University of California, Water Resources Archives, Beth Willard, Librarian (213) 825-7734

This reference library has an extensive collection of publications, manuscripts and material relevant to this study. There is a large collection of uncataloged documents from local agencies as well. In addition, material not available at the UCLA Water Resources Archives can usually be obtained from Berkeley through UCLA. Sources are well cataloged and easy to find.

California Department of Water Resources, Southern Division, Los Angeles

The records and documents section combine an extensive collection of California State publications. In addition, there is a large collection of relevant documents and publications from local and federal agencies, including the County Flood Control Agencies. Sources are well cataloged and easy to find.

California Institute of Technology Libraries

Extensive collection of relevant journals and some federal and state publications. The best sources are the Environmental Engineering Library, Keck Laboratory, and the Engineering Library (Millikin Libraries). Unfortunately, the collections are spread out over several buildings and a certain amount of searching is often required.

University of California, Los Angeles Engineering Library and Geology Library

These two libraries have extensive collections of relevant journals. The Engineering Library has vast holdings of Weather Bureau/Weather Service publications. The geology library has all relevant U.S. Geological Survey Water-Supply Papers (as do the Water Resources Archives, where they cannot be checked out) and other U.S.G.S. publications. Both are excellent sources for reference material.

Corps of Engineers, Los Angeles District Library

This library has most Corps of Engineers publications, including Beach Erosion Board and CERC publications. Some publications from local and state agencies are also available, as are some U.S.G.S. Water-Supply Papers. References are often miscataloged and difficult to find.

C.2 Hydrologic Data Available

Table 2.9 can be used as a quick reference to stream gages in this region. More detailed information is presented in Appendix A.

C.2.1 Major Streams - Tijuana, San Diego, San Dieguito, San Luis Rey and Santa Margarita Rivers

These rivers are all presently well controlled, and for the greater part have been gauged for more than sixty years. The relevant gages are, with one exception on the San Dieguito River, maintained by the U.S.G.S. Daily discharge data are available in U.S.G.S. publications and in computer files in the Sacramento office (John Beck). In addition, charts or digital tapes from recording gages are available at the Laguna Niguel office.

With the exception of the San Dieguito River, daily sediment measurements were made in these rivers from October 1968 until September 1978. These data are available in reduced form in U.S.G.S. publications and in the computer files (WATSTORE) at the Sacramento office (John Beck). The data measurements, including size distributions, are also available at Laguna Niguel (Chris McConaughy).

C.2.2 Laguna Hills Group

The major streams in this group are the San Juan Creek and Arroyo Trabuco. These streams should be combined to give the streamflow at the ocean of San Juan Creek. Data from the Arroyo Trabuco are available at the Orange County Environmental Management Agency. Tabulated daily flows and charts from the recording gages are available. The San Juan Creek is gauged by the U.S.G.S. and data are available from this agency as noted in Section C.2.1.

Daily sediment measurements have been made in San Juan Creek and these measurements are continuing. These data are available from the U.S.G.S. as noted in Section C.2.1.

The San Mateo and San Onofre Creek gages are maintained by the U.S. Marine Corps at Camp Pendleton. Data on these creeks start in 1946, and these data are available through the Department of Natural Resources, Camp Pendleton.

C.2.3 Escondido Creek, San Clemente Creek and San Diego Stream Group

The Escondido Creek Group is relatively unimportant in terms of sediment yield, since all major streams terminate in lagoons or marshes. Escondido, San Marcos, Loma Alta and Buena Vista Creeks are all gauged by San Diego County Flood Control District. Data are available from this agency in tabular form (daily) and charts or digitized tapes from recording gages are also maintained.

The San Clemente Creek and San Diego Groups are for the most part in urban areas. The major stream in these groups is the Los Peñasquitos Creek, gauged by the U.S.G.S. Data are available as noted in Section C.2.1.

C.2.4 Sweetwater and Otay Rivers

These rivers are gauged at the Sweetwater Reservoir and at the Otay Reservoir by the San Diego County Flood Control District. There is runoff only when the reservoirs spill, and this runoff goes to San Diego Bay. Data are available from the San Diego County Flood Control District as noted in Section C.2.3.

C.2.5 Forest fires and their effects

The best source of data on fires in this region are the fire maps produced during the Caltech Sediment Management Project. These maps, provided under a separate cover, show all significant fires from 1910 to 1975. Recent data are available from the U.S. Forest Service and the California Division of Forestry. Wade Wells of the U.S. Forest Service, Riverside should be contacted for specific direction in obtaining recent fire maps. There are sufficient data, particularly in the Caltech fire maps, to enable the development of fire-area-frequency analyses for this region.

C.2.6 Frequency analyses

Peak-flow frequency analyses have been performed for most streams by the San Diego County Flood Control District. However, these analyses are based on maximum rainfall intensity and not on measured peak flows. Data exist from the various agencies (peak flow, annual volume, etc.) that could be used to make frequency analyses, but this has not been done recently in this region, except for those analyses published by the U.S.G.S. (Waananen and Crippen, 1977; Young and Cruff, 1967).

The California Department of Water Resources (Bulletin 112) has done flood frequency analysis for the major rivers of this region (except the Santa Margarita and Tijuana Rivers). This analysis was based on peak annual flow data up to 1960.

C.2.7 Other relevant data

There are only a few debris basins in this region, and no data are kept on cleanouts. All the major rivers have water-supply reservoirs, but these have never been cleaned out.

Estimates of debris accumulation in reservoirs in this region were made by Taylor (1981). These data are helpful in determining effects of dams on the river systems.

An analysis of effects of mining operations in this region was made by Kolker (1982). Statistics on mining are available from the U.S. Bureau of Mines Mineral Yearbook; other data are available in Evans et al. (1977).

D. Data Gaps and Limitations

Sediment measurements have been made in most of the major streams in this group for the period of 1968 through 1978. There are few recent data, but the data cover both wet and dry periods, and estimates have been made of the total actual and natural supply of sand to the coast (Brownlie, 1981). Thus, the effects of dams as well as the sediment supply have been well estimated.

Streamflow history is also well documented in this region, with more than forty years of data on all major streams; some have more than seventy years of data. Most major streams also have recording gages, so that hydrographs are also available.

Recent volume-frequency analyses have not been done, although the data are available and in an easily accessible form (U.S.G.S. computer files, Sacramento, John Beck) for the major streams. Record lengths are certainly adequate for obtaining accurate results.

Effects of dams, of mining operations and of the few debris basins in the region can be found in Brownlie (1981) and Kolker (1982). This region is well covered in this respect, in part because of the sediment measurements available. A study on sediment in Morena Reservoir is also available (San Diego City, 1953). Ritter (1972) has studied the sedimentation in the Agua Hedionda Lagoon.

The fire history in this region is adequately known from 1910 to the present. However, fire frequency studies are needed. These could be done in conjunction with other agencies (U.S. Forest Service, California Division of Forestry). This is not as critical a problem as in other regions, because the large number of dams downstream of potential burn areas reduces the effects of fire on coastal sediment delivery.

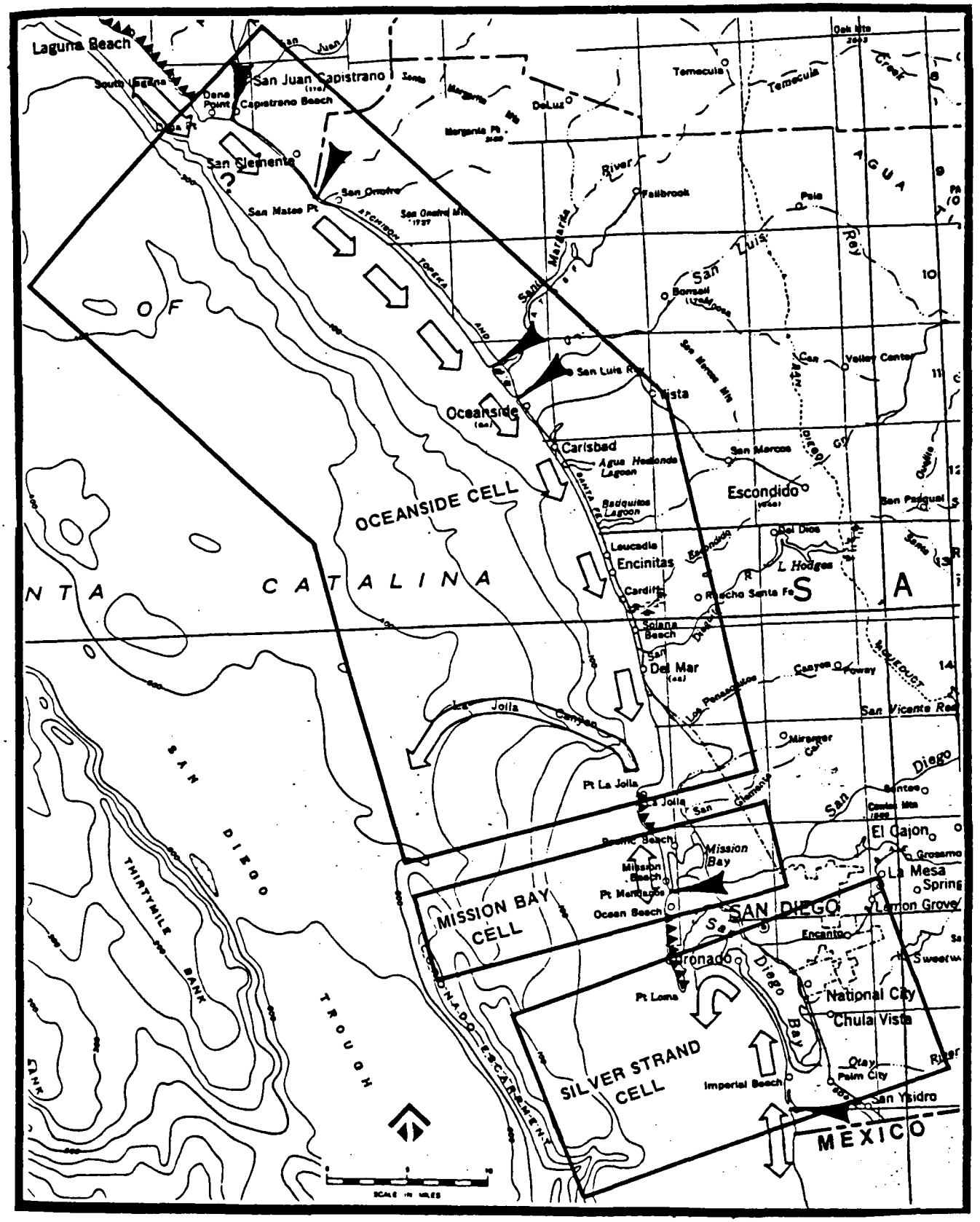

Figure 2.1 San Diego Region

Source: Calif. DNOD Atlas of Shoreline Erosion

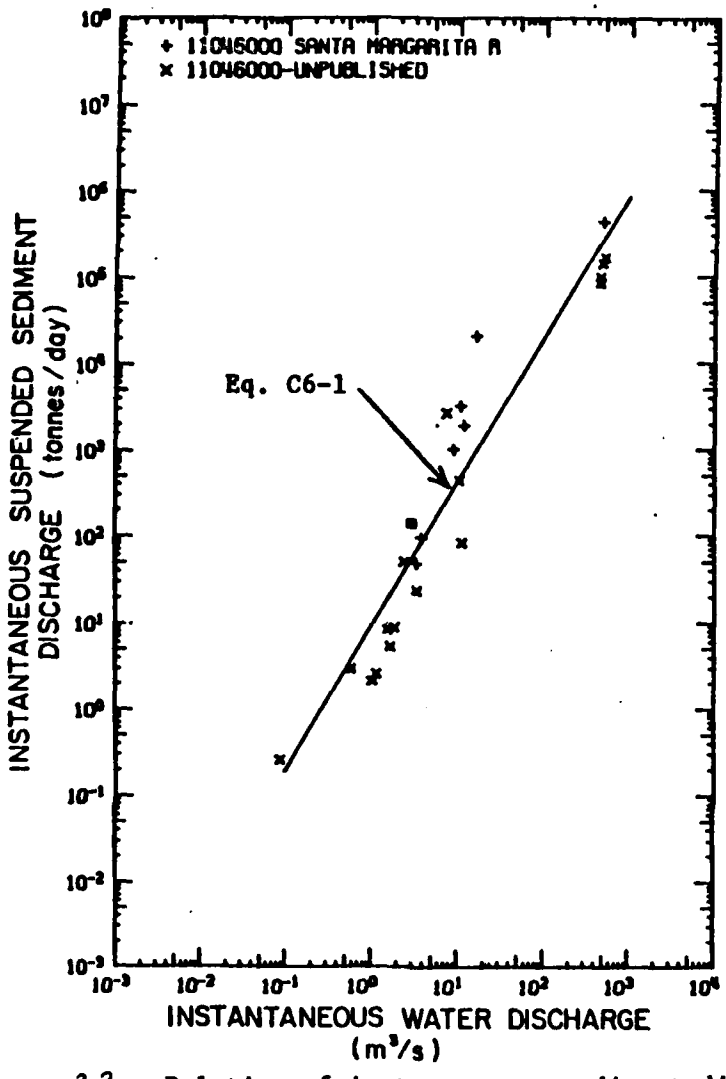

Figure 2.2 Relation of instantaneous sediment discharge to water discharge at Santa Margarita River station 11046000, 1969-76.

Source: Brownlie (1981)

TABLE 2.1

Major Drainage Areas of the San Diego Region

Basin or Group	Littoral Cell	Drainage Area mi^2	Controlled Area mi^2	Percent Controlled
Laguna Hills Grp	Oceanside	470	---	--
Santa Margarita R	Oceanside	744	370	50
San Luis Rey R	Oceanside	560	205	37
Escondido Cr Grp	Oceanside	220	---	--
San Dieguito R	Oceanside	346	303	88
San Clemente Cyn Grp	Oceanside S Oceanside R	169	---	--
San Diego R	Mission Bay	432	265	61
San Diego Grp	S Mission Bay Silver Strand	60	---	--
Sweetwater R	Silver Strand	220	182	83
Otay R	Silver Strand	143	99	69
Tijuana R	Silver Strand	1730	1225	72
Total		5094	2649	52

Source: Brownlie and Taylor (1981)

TABLE 2.2

River Features in the San Diego Region

River	Length Mi (approx)	Maximum Elevation ft	Slope Range	Other Features
Santa Margarita	55	6800	0.002-0.005	Drains to marsh
San Luis Rey	60	6500	0.003-0.055	
San Diequito	55	5700	0.003-0.04	Becomes Santa Ysabel Creek above L Hodges
San Diego	50	5700	0.004-0.04	Heavily controlled, urbanized. Gentle slope lower 30 mi.
Sweetwater	50	6500	.004	Heavily controlled, urbanized.
Tijuana R	80	3800	0.003	Heavily controlled.

TABLE 2.3

Annual Precipitation at Selected Stations, San Diego Region

Location	Elevation ft.	Precipitation Average	Maximum	Minimum	Years of Record	Longitude / Latitude
San Juan Capistrano 7836-51	151	14.4	31.4	4.8	73	33-30-45 117-38-10
Temecula 8840-01	1020	15.2	32.7	4.9	39	33-29-45 117-08-57
Palomar 6657-00	5545	27.8	61.7	10.0	38	33-21-21 116-51-40
Henshaw Dam 3914-00	2700	26.5	52.4	8.3	69	33-14-15 116-45-37
Escondido 2862-00	666	15.7	34.6	6.1	82	33-07-10 117-06-35
Miramar 5707-01	650	13.7	30.0	6.3	53	32-54-00 117-06-00
Cuyamaca 2239-00	4650	38.3	66.5	12.1	93	32-59-20 116-35-15
San Diego 7740-00	13	9.9	26.0	3.4	130	32-43-59 117-10-32
Barrett Dam 0514-00	1624	17.7	36.4	6.8	65	32-40-48 116-40-15

Source: DWR Bull. 230-81

TABLE 2.4

Mean Monthly Precipitation in Inches* at Selected Stations, San Diego Region

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palomar	4.9	4.7	4.7	2.5	0.4	0.1	0.4	0.5	0.4	0.8	3.1	4.6
Henshaw Dam	4.2	3.7	3.9	2.3	0.5	0.1	0.2	0.48	0.3	0.7	2.6	3.7
Escondido	2.6	2.2	2.5	1.4	0.3	0.1	.03	0.1	0.2	0.5	1.8	2.4
Cuyamaca	5.6	5.4	6.1	3.7	1.1	0.2	0.5	0.5	0.6	1.0	3.5	5.2
San Diego	1.9	1.5	1.6	0.8	0.2	.03	.01	0.1	0.1	0.3	1.3	1.7
Barrett Dam	2.9	2.5	2.7	1.8	0.9	0.1	.03	.03	0.3	1.0	3.0	4.4

*1941-1970

Source: Goodridge, (1981)

TABLE 2.5
Major Control Structures, San Diego Region

Name	Watershed	Drainage Area mi^2	Year Completed	Remarks
O'Neill Lake	Fallbrook Cr (Santa Margarita R)	27	1885	
Skinner Res	Tucalota Cr (Santa Margarita R)	51.5	1973	
Vail Lake	Temecula Cr (Santa Margarita R)	306	1949	
Henshaw Lake	San Luis Rey R	207	1923	Also diverts to Lake Wohlford.
Lake Wohlford	Escondido Cr	8.0	1924	Water-supply and flood control.
Lake Hodges	San Diequito R	303	1919	Water-supply and flood control.
Sutherland Res	San Diequito R	54	1954	Upstream of Lake Hodges.
San Vicente Res	San Vicente Cr (San Diego R)	74.1	1943	Water-supply and flood control.
Murray Res	San Diego R	3.6	1918	
El Capitan	San Diego R	190	1934	Water-supply and flood control.
Cuyamaca Res	San Diego R	12	1887	Upstream of El Capitan.
Sweetwater Res	Sweetwater R	182	1888	Failed in 1916 flood.
Loveland Res	Sweetwater R	98	1945	Upstream of Sweetwater Res
Otay Res	Otay R	101	1919	
Barrett Lake	Cottonwood Cr (Tijuana R)	252	1922	Water-supply and flood control.
Lake Morena	Cottonwood Cr Tijuana R	114	1912	Water-supply and flood control.
Rodriguez Res	Tijuana R	976	1936	In Mexico.

Source: DWR Bull. 17-84

TABLE 2.6

Streamflow and Sediment Delivery, San Diego Region

River/Streams	Ave Flow cfs	Max Flow cfs - year		Sediment Ave 1000 tons/yr	Sediment Max - Day 1000 tons/day		Remarks
San Juan Cr	31.2	30300	1969	N.A.	331	1978	Discharge includes Arroyo Tribuco.
Santa Margarita R	33.9	33600	1927	47 eq	534	1969	eq = EQL estimate
San Luis Rey R	31.6	95600	1916	73 eq	59	1978	
San Diequito R	17	72000	1916	16 eq	N.A.		Controlled by L. Hodges.
San Diego R	24.9	70200	1916	27 eq	3	1978	
Tijuana R	45.8	33500	1980	178 eq	122	1978	

N.A. = not available

Sources: Brownlie and Taylor (1981)
U.S.G.S. Water-Supply Papers

TABLE 2.7

Peak Flows (CFS) During Major Floods, San Diego Region

Stream	1916	1927	1938	1943	1969	1978	1980	1937*	1941*	U.S.G.S gage	Drainge area mi²
Tijuana R	N.A.	N.A.	6760	1060	553	3000	34200	17700	13800	11-0135.	1695.
Sweetwater R	112600	33900	11000	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		182
San Diego R	70200	45400	7350	1400	1830	2850	9370	14200	9250	11-0225.	377
San Luis Rey R	95600	N.A.	16500	3770	5000	8250	19000	16500	2680	11-0420.	560
Santa Margarita R	N.A.	33600	31000	19000	19200	21200	18500	23000	9600	11-0460.	740
San Juan Creek	N.A.	N.A.	17400	8650	29400	8500	14500	17500	2400	11-0465	117

*High flows, but not necessarily floods.

Source: U.S.G.S. Water-Supply Papers
U.S.G.S. Water Resources Data for California

TABLE 2.8

Major Forest Fires, San Diego Region 1910-1975

Year	M/day	Location	Watershed(s)	Area Burned (acres)
1913	N.A.	Orosco Ridge Temescal Cr	San Diequito R Santa Ysabel Cr	32400
1913	N.A.	Iron Mtn San Vicente Cr	San Diego R	32500
1928		Mt Gower San Vicente Cr	San Diego R	28000
1928	N.A.	Mt Palomar Temecula Cr	San Luis Rey Santa Margarita	67000
1928	N.A.	Red Mtn Wilson Cr	Santa Margarita Elsinor Lk	57000*
1929	N.A.	El Capitan Res	San Diego R	20000
1929	N.A.	Sutherland Res	San Diego R	25500
1943	N.A.	Escondido Cr	Escondido Cr San Diequito R	39000
1943	N.A.	Otay Res	Otay R Tijuana R Sweetwater R	49400
1944	N.A.	Beauty Pk Culp Valley	Santa Margarita R	23600
1944	N.A.	La Posta Reservation	Tijuana R	46700
1945	N.A.	Sandia Cyn	Santa Margarita R	43100
1950	N.A.	El Capitan Res	San Diego R Sweetwater R	62400
1953	N.A.	Weaver Mtn	San Luis Rey R	19200
1956	N.A.	San Juan Cyn	San Juan Cr	55900
1967	10/29	Santiago Res	Santa Ana R	45200*

*Includes area burned in South Coast Region.

(continued on next page)

TABLE 2.8

Major Forest Fires, San Diego Region 1910-1975
(continued)

Year	M/day	Location	Watershed(s)	Area Burned (acres)
1967	10/30	Goodson Mtn	San Diequito R	30200
1969	8/22	Gavilan Mtn	Santa Margarita R	19200
1969	8/22	San Onofre Cyn	Santa Margarita R San Onofre Cr	14800
1970	9/26	Barnet Lake Los Piños Mtn	Sweetwater R Otay R Tijuana R	172500
1970	9/28	Cuyamaca	San Diego R	13400

N.A. = not available

Source: Caltech EQL Fire Maps, Wells (1987)

TABLE 2.9 PRINCIPAL STREAM GAGES, SAN DIEGO REGION

STATION	AGENCY	PERIOD OF RECORD	TYPE*	USGS #	OTHER #	REMARKS
Tijuana River	USGS	1914, 1936-1981	R	11-0135.00	SDC 259	Sediment measurements 1969 - 1978
San Diego River	USGS	1912-1915 1916-	F F,R	11-0225.00	SDC 263	Sediment 1969-1978
Los Penasquitos Creek	USGS	1964-	R	11.0233.50	SDC 260	Sediment 1981-1982
San Dieguito River	USGS SDC	1916-1961 1970-	R	11-0300.00		
Escondido Creek	SDC	1971-1977	R	11-0307.30	SDC 594	
San Luis Rey River	USGS	1912-1914, 1916 1925-1942 1946-	F,R	11-0420.00	SDC 271	Sediment 1968-1978
Santa Margarita River	USGS	1923-	R	11-0460.00	SDC 279	Sediment 1968-1978
Las Flores Creek	USGS	1951-1939	R	11-0461.00	SDC 280	Sediment 1981-1982
San Juan Creek	USGS	1928-1968 1969-	R	11-0465.00 11-0465.50	--- ---	Sediment 1970-Present
Arroyo Trabuco	OC	1932-	R	11-0470.00	OC 5	

Note: Latitudes, Longitudes and drainage areas of these and other gages are listed in Appendix A.

* F = daily flow
R = recording gage

3.0 SOUTH COAST REGION

The South Coast Region includes portions of Los Angeles, Orange, San Bernardino and Riverside Counties. The extent of the South Coast Region is defined by the watersheds draining to the Santa Monica littoral cell, which extends from Solromar to Point Vicente, the South Santa Monica Reach, which covers the area from Point Vicente to Point Fermin, the San Pedro littoral cell, which extends from Point Fermin to just south of the Newport Harbor entrance and the South San Pedro Reach, which covers the area from the San Pedro Cell to Dana Point. The littoral cells correspond to those defined in the Assessment and Atlas of Shoreline Erosion Along the California Coast (July 1977) and are shown in Figures 3.1 and 3.2, taken from this document. The following sections give general hydrologic information regarding the watersheds draining into these regions.

A. Drainage Areas

A.1 Drainage Areas and Sub-Areas

From an historical point of view, there were four distinct watersheds which drained into the South Coast Region. These are indicated on Plate 3.1 as the Los Angeles River Basin, the San Gabriel River Basin, the Santa Ana River Basin and the Santa Monica Mountains Group. However, due to the extensive development and flood control projects in the South Coast Region, only the upper reaches of the San Gabriel and Los Angeles Rivers can still be considered as hydrologically distinct. The lower reaches are channeled, and the two rivers are not entirely independent, since they are connected naturally and, more recently, artificially. Table 3.1 contains pertinent data on the main basins of this region.

The Santa Monica Mountains Group can be divided into five sub-areas, the most important of these for the purposes of this study being the Malibu Creek drainage area and the Ballona Creek drainage area. Also, of importance, but covering a smaller area is the Topanga-Mandeville Canyon area, and the coastal canyons in the western portion of the Santa Monica Mountains Group. Of somewhat lesser importance are the developed areas west and south of Ballona Creek, a large fraction of which is drained into the Los Angeles Harbor via storm drains emptying into the Dominguez Channel.

The Los Angeles River originates in the Santa Monica and Santa Susana Mountains, which border the western portion of the San Fernando Valley. A major sub-area which drains into the Los Angeles River is that formed by the watersheds of the Pacoima and Tujunga Creeks, whose sources are in the western end of the San Gabriel Mountains. The other major sub-area is that drained by the Arroyo Seco, which also has its sources in the San Gabriel Mountains. The Rio Hondo drains to the Los Angeles River via the flood control basin at Whittier Narrows, and the Los Angeles River thus drains a portion of the central San Gabriel Mountains, including the Eaton Wash area, thus a precise separation of the San Gabriel River and Los Angeles River drainage is no longer possible in this area.

The San Gabriel River drains the eastern portions of the San Gabriel Mountains and the Los Angeles Basin. Major sub-areas of the San Gabriel River include the San Gabriel Mountains, where the East and West Forks of the San Gabriel River drain a central trough in the mountains. A second major sub-area is that of the southern face of the San Gabriel Mountains, including the areas drained by the Little and Big Dalton Washes, the San Dimas Wash and the Walnut Creek Wash. On the eastern boundary of the watershed is the source of the San Jose Creek. Another large sub-area is that drained by Coyote Creek, which includes the sources of the Brea and Fullerton Creeks.

The Santa Ana River drains from the San Bernardino, Santa Ana and San Gabriel Mountains. A portion of the Santa Ana River Basin drains into Lake Elsinore, which is the sink of a major hydrologic unit, usually a confined basin. Overflows from Lake Elsinore have been recorded in 1916 and 1980, but the

lake usually serves as the final sink for runoff from the San Jacinto River.

Major sub-areas draining to the Santa Ana River include the Mentone sub-basin, which includes the Big Bear Lake region of the San Bernardino Mountains, the San Bernardino sub-basin, which includes the San Timoteo Wash, the Colton sub-basin, which includes the Lytle Creek and Cajon Washes, the Riverside sub-basin, the Prado sub-basin, which includes Prado Dam, Cucamonga Creek and San Antonio Creek, and the Temescal sub-basin, which includes the Temescal Wash, through which passes the rare overflow from Lake Elsinore.

South of the Santa Ana River Basin is the Laguna Hills drainage group, the southern part of which lies completely out of the Santa Ana Basin, and includes Aliso Creek. The northern portion includes San Diego Creek and Peters Canyon Wash.

A.2 Physiography and Topography of the South Coast Region

The watersheds draining to the South Coast Region are bounded on the north and west by the western Transverse Range Mountains, including the San Gabriel Mountains, and the eastern end of the Santa Susana Mountains and the Santa Monica Mountains. On the eastern side, the drainage area is bounded by the Puente and East Coyote Hills and by heavy development.

The Transverse Mountain ranges were formed by an interaction of an east-west oceanic fracture zone with the San Andreas fault. The development of these ranges is so recent and extreme that some drainages can be considered avalanche chutes (Scott and Williams, 1974). During the uplift of the San Gabriel Mountains, shallow seas covered the southern and western areas; later tectonic activity uplifted these areas to form the Santa Monica Mountains and Santa Susana Mountains.

The region is so geologically young that the major rivers are antecedent. This antecedence is demonstrated in the downcutting at Elysian Park by the Los Angeles River, and at Whittier Narrows, by the San Gabriel River. Table 3.2 lists some features of the major streams in this region.

The main stem of the Los Angeles River is about 55 miles in length. River slopes are moderate in the coastal plains and the San Fernando Valley (the order of 0.003-0.006) and high in the upland tributaries (0.04) (Brownlie and Taylor, 1981). Forty percent of the drainage area is controlled by water retention structures, and the valley and coastal plains areas are heavily developed.

The San Gabriel River basin drains the central segment of the San Gabriel Mountains. The upper reaches of the San Gabriel River flow down an eroded trough in the San Gabriel fault zone. The mountains in this area rise to over 9000 feet, and slopes in some of the tributaries are on the order of 20% (Coldwater Canyon area). In the coastal plains and valleys, however, the slopes of the river are much gentler (0.003-.006). About 84% of the basin is controlled by water retention structures.

The Santa Monica Mountains form a relatively small coastal drainage group. They are a low mountain group relative to the San Gabriel Mountains, with the highest peaks at about 2200 feet. The western portion of the range drains through a heavily developed portion of the Los Angeles basin.

The Santa Ana River flows from the San Bernardino Mountains to the Pacific Coast traversing some 100 miles. The river slope is on the order of 0.003 to 0.005 in the valley areas, decreasing to 0.001 near the coast, but rising to a high of 0.05 in the mountains. The upper reaches of the Santa Ana River and its tributaries are found in the San Bernardino, San Gabriel and Santa Ana Mountains. Roughly one third of the basin is mountainous terrain, the peaks of which rise to over 10,000 feet. At the lower levels, near San Bernardino, the drainage area includes agricultural and urban developments; towards the coast, the area is heavily urbanized.

A.3 Climate of the South Coast Region

The South Coast Region is classified as belonging to the Mediterranean Dry Summer Subtropical climatic type. Along the maritime fringe, temperatures are controlled by the sea, with average winter air temperatures of 52° F and average summer temperatures near 72° F. Inland summer temperatures are much higher, with summer highs commonly over 90° F, while winter daytime temperatures are only occasionally below freezing.

As is indicated by the climatic type, summers in this region are generally dry, and winters wet. Over 90% of all precipitation falls in the six month period from November to April, with 50% recorded in the winter months of December through February. Typical rainfall patterns for this region are summarized in Tables 3.3 and 3.4.

The typical winter storms which affect this region are usually of high or mid-latitude origin, and approach from the northwest, west and southwest. The nature and general approach of these storms help produce conditions which yield the strong orographic effects in the rainfall patterns observed in this region. The orographic effects can be seen in Table 3.3, where a strong relationship between elevation and rainfall is seen.

Of great importance in the region are the foehn-type winds called Santa Anas. These hot dry winds originate from a high-pressure center over the Great Basin, and blow seaward from the north or northeast. The adiabatic heating of the air as it descends from the high plateau can cause hot and dry conditions which can result in severe fire danger. These conditions can develop at any time of the year, but are most common in fall and winter, developing a day or so after the passage of a cold front (Sergius, 1962). A more complete description of the climate is found in the companion hydrology report.

A.4 Soils and Vegetation of the South Coast Region

An excellent overview of the vegetation in this region is given by Wells and

Palmer (1982), who have developed maps of both present and original vegetation patterns in the Southern California coastal region.

The South Coast Region is presently characterized by heavy urban development which covers the plains and valley areas. These areas were once largely grassland and coastal sage shrub areas. The mountainous areas are rugged with steep narrow canyons and have resisted development. These areas remain, for themost part, covered by chaparral.

Chaparral is considered to be the most important vegetation type in the area. It is both an efficient watershed protector and slope stabilizer and is extremely susceptible to fire. Chaparral plants are evergreen, sclerophyll shrubs with extremely strong root systems. Chaparral plants are well adapted to steep, rugged terrain as they form deep, extensive root systems. The slopes of the San Gabriel Mountains and all but the lower coastal portion of the Santa Monica Mountains are characterized by chaparral vegetation.

The second predominant type of vegetation is the coastal sage shrub. This type is similar to chaparral, but is smaller, less woody and is a less effective soil stabilizer. This type occurs along the coast in the Santa Monica Mountains and in the foothills of the San Gabriel Mountains. It tends to occur on depositional sites, especially those with coarse-textured soils.

At higher elevations (above 5000 feet), the vegetation is generally coniferous forest, except at the highest peaks, above the timberline, where it is alpine in nature. The coniferous forests are generally in erosional zones, where soils are shallow, coarse and poorly developed.

There are two extant coastal salt marshes in this region, one just south of the present outlet of the San Gabriel River, the other above Newport Harbor in the San Diego Creek area. Previously, salt marshes existed in the now developed areas of Marina del Rey and the Wilmington-Long Beach areas. Of these, the salt marsh at the terminus of the San Diego Creek is probably a significant sand trap; the others presently have little effect on sediment transport to the ocean.

Exposed rock in the mountainous areas are largely Pre-Cambrian gneisses and schists and have been intruded by granite rocks. The rocks have been continually uplifted since Tertiary time and the surrounding basins have been supplied with coarse granite and metamorphic materials. The steep rugged slopes of the mountains make them vulnerable to erosional processes. Some areas are so steep that dry erosion is common (Scott and Williams,1978). The base of the mountains and valleys are covered with alluvium, in some cases quite coarse, as is found in the upper reaches of the Santa Ana River. The high erodibility of the mountains is evident not just in the coarse alluvium, however. When the soil stabilizing chaparral is stripped away by fire, erosion rates increase by orders of magnitude (Wells, 1982).

A.5 Development and Structures Affecting Runoff

The total surface area of the South Coast Region, excluding the confined

Lake Elsinore basin, is approximately 4,000 mi.^{2} Of this area, approximately 50% is extensively developed (Wells and Palmer, 1982). The greater portion of the developed areas are urbanized, especially in the Los Angeles and San Gabriel River Basins. Only the Santa Monica Mountains Group and the rugged mountainous terrain of the San Gabriel, Santa Ana and San Bernardino Mountains have eluded development.

As would be expected in a heavily developed area, extensive controls have been constructed in the major river basins. The Los Angeles and San Gabriel River systems together count seventeen flood control reservoirs and basins, several artificial spreading basins, 120 debris basins (as of August 1984) and over 300 check dams. The major control structures are shown in Plate 3.2, which gives a schematic of the region and the major basins. Plate 3.1 also shows major sand and gravel mines in the region.Table 3.5 lists the major structures along with pertinent features.

The Santa Ana River, also shown in schematic form in Plate 3.2, includes six major reservoirs, including Prado Dam, the major control structure along the river. In addition, there are a number of diversions along the Santa Ana River. In the Mentone sub-basin, most runoff is diverted to percolation basins, with only large storm flows allowed to pass downstream (Taylor, 1981). Some surface runoff is also lost to natural and artificial groundwater recharge in the San Bernardino, Colton and Riverside sub-basins. Prado Dam outflow is also heavily controlled, to allow maximum ground water recharge. Below Prado Dam, Orange County has one active debris basin, and two just completed on the San Diego Creek (Collicott, 1985, personal communication).

The Santa Monica Mountains Group has few controls but does have several debris basins in the Mandeville Canyon area. In addition, there are water storage reservoirs in the Malibu Creek basin.

A.6 Runoff and Sediment Characteristics, South Coast Region

The most prominent characteristic of runoff in the drainage areas of the South Coast Region is the high degree of intermittency of flow. It is not uncommon to have zero flow recorded, and yet the maximum daily recorded flows are typically on the order of 1,000 times the mean daily flow. Table 3.6 shows some characteristics of runoff data for major streams of the region.

The statistics in Table 3.6 point out another characteristic of the region: the extreme variability of flow from one watershed to the next. This is due in part to the controls on the more important systems, although there is some natural variability as well. As pointed out by Taylor (1981), one cannot simply scale the runoff from one basin by area in order to determine the runoff from another basin. The large differences are due to variations in surface hydrology as well as artificial controls. Many washes in the Santa Ana River basin are, for example, composed of coarse alluvium with high percolation rates. Large quantities of surface runoff are thus lost to groundwater. Increased development has also resulted in changes in runoff, and the large number of controls, particularly spreading basins in the Santa Ana River basin, contribute to

observed variations among basins. Typical discharge hyrdographs of major streams in this region are presented in Appendix B.

The sediment characteristics of the region are more difficult to quantify. Taylor estimated the annual delivery to the coast by the Los Angeles River, but based the estimates on river delta accumulation. His results are at best estimates, since there are numerous factors which make these data questionable including the small size of coast that was surveyed.

Measurements on the Santa Ana River give, perhaps, the best general view of sediment conditions. Measured sediment discharge in the 1969 flood year at Santa Ana was 6 million yd^3 but approximately 13.5 million yd^3 was deposited behind Prado Dam. From 1941 to 1960, the average annual deposition at Prado Dam was 0.3 million yd^3; the 1969 flood more than doubled the retained sediment volume. The average annual sediment discharge from the Santa Ana River is 0.1 million yd^3 (Taylor, 1981). One sees here both the variability of sediment yield and the enormous effects of control structures.

There are also few data on sediment size characteristics. Bed material in the Santa Ana River tends to be primarily sand with a mean diameter of 0.02" (0.5 mm). The few measured size distributions of suspended sediment in the Los Angeles River shows a seasonal dependence. In winter as much as 90 to 95% is finer than 0.002" (0.06mm); in summer, the fraction often drops to 50 % (U.S.G.S., Water Resources Data, California). In the Santa Ana River, the suspended sediment is somewhat coarser, as would be expected since the Los Angeles River is a concrete channel, and the Santa Ana River has a sand bed. During the 1980 floods, 50 to 70%, depending on the time of measurement, of the suspended load was finer than 0.002" (0.062 mm). Typical sediment size distribution measured in this region are presented in Appendix B.

A.7 Forest Fires in the South Coast Region

Forest fires are of extreme importance in the sedimentation and erosional processes in this region. Wells (1982) estimates that post-fire erosion in the San Gabriel Mountains is responsible for as much as 80 to 90% of all erosion. The chaparral common to the upland areas is largely responsible. While an excellent soil stabilizer, chaparral is one of the most flammable vegetation complexes known. The fire potential in chaparral becomes more extreme with age, as up to 50% of the plant biomass may be dead after 30 years (Wells, 1982).

In addition to this natural fuel covering the mountain watersheds, the local climate is conducive to fires as well. Santa Ana winds, which can occur during any season, often result in hot, dry winds, especially in fall at the end of the dry season. The "fire weather" which develops is considered to be extreme and is considered by the Forest Service to be among the most dangerous to occur in the United States (McCutcheon, 1977).

According to Wells, nearly all upland watersheds in this region have burned once, and some, three or four times since 1910. The burns in the Santa Monica Mountains have almost all been deliberately or accidentally set by humans

(Radtke, et al., 1982); in the San Gabriel and San Bernardino areas, thunderstorm activity, which often produces lightning but insufficient rain to suppress fires, is also a factor in fires.

B. Historical Perspective

B.1 Historical Outline of Major Floods and Erosional Events

The most comprehensive account of flooding in this region before 1916 is given by Lynch (1931), who used diaries, memoirs and crop records to compile the historical record. The most interesting result of his research is that large floods often occurred during drought periods. This is true for the floods of 1825, 1862, 1952 and 1969. The floods of 1825, 1862 and 1969 were among the most severe that have been recorded. Table 3.7 lists the major floods in this region.

The large number of floods reported in the 1800's by Lynch may reflect both the lack of flood control and, perhaps, exaggerations in historical accounts. Several floods, however, were more severe than anything experienced in the past 85 years. Kuhn and Shepard (1981) report that the flood of 1861-62 affected not just the South Coast Region but all California and (Kuhn, 1985, personal communication) most of the Western United States. California and eleven other states went bankrupt because of the flooding and resulting economic damage. The entire plains area, from Los Angeles to the ocean, from Ballona Creek to San Pedro, was a great lake.

Lynch also gives indicators that some of the floods in this period were more intense than any in more recent history. Lake Elsinore, for example, filled from near empty to overflowing in 1862, and from 1/8th full to overflowing in 1883-84. In more recent times, it has overflowed in 1916 and 1980. However, since the 1890's, the overflow elevation was lowered, and Lake Elsinore overflowed at about 1260 feet in 1916 and 1980, as opposed to 1266 feet in earlier times (Lynch, 1931; White, 1980).

The period 1944 to 1977 is generally considered to be a period of subnormal rainfall, and only one major flood occurred (1969), although there was lesser flooding in 1942-43, 1951-52, 1961-62 and 1965-66. In part, the reduction in flooding is due to flood control, since based on Lynch's index, more rain fell in the 1940-41 season than probably fell in 1862 or in 1825. However, the rainfall of 1940-41 was spread throughout the year and thus total seasonal rainfall is not always an indicator of flood potential.

The historical perspective on erosion and sedimentation is not very good, but there are some indicators. Kuhn and Shepard (1981) note that the 1862 flood waters carried great quantities of sediment to the sea and helped "develop a wide beach". The 1825 flood "made wide ravines in some places, and in others covered the soil with sand." Several references are made to the sandy beds of the Santa Ana and San Gabriel Rivers. While sediment has been referred to, little quantitative work has been done until the last 50 years, when sediment became a real economic problem. McGlashan (1918) mentions the sediment problem in the 1916 flood, and by 1919, reports start mentioning fire effects and sedimentation (Munn, 1919 and 1920). The 1938 flood brought some attempts to quantify the sediment problem as did the storm in 1933 which resulted in local flooding in La Crescenta (Kraebel, 1934; Troxell, 1942; Bamesberger, 1939). The latter publication attempts to quantify erosional losses in several watersheds in the

region. They estimated over 120 cubic yards of soil were lost per acre in uncontrolled areas.

Despite the obvious problem, there has been no definitive historical account. The Los Angeles County Department of Public Works (formerly Flood Control District) measures sediment accumulation in debris basins, and has published reports on the fire-flood-sediment problem. Only since the late 1960's has sediment been measured in streams on a regular basis, and the most comprehensive measurements are in the Santa Ana River in this region. Kroll (1975) estimates that 99% of all sediment movement took place on 1% of the days from 1941 to 1971, based on 1968-1971 measurements, heavily weighted by the 1969 floods.

B.2 Historical Outline of Fires in the South Coast Region

Radtke, et al. (1982) give the only definitive fire history for any portion of this region, but their study is limited to the Santa Monica Mountains. Their account starts with the historical record in 1900 and is divided into two parts: pre- and post-1918. In 1919, fire suppression was actively introduced into the region. Radtke points out that in the recorded history of this area almost all fires have been deliberately or accidentally started by humans. There are few references to fires prior to 1900; Radtke, et al. point out that deliberately set fires by ranchers were common prior to 1900, but that burnings by the native population prior to European settlements was probably limited.

Also found in the study are the facts that fires prior to 1918 were large and that the region burned twice, on the average, in 18 years. Since 1919, fires have been smaller and many areas have burned only once or not at all. Radtke, et al. find that most fires occur in Santa Ana wind conditions.

The only other compilation of fire data for this region was done by Sayer, Brown and Brown (1981, unpublished). A summary map showing the areas burned from 1910 to 1975 is presented by Wells (1982) in the EQL Report 17-D. This map indicates that the chaparral and coastal sage areas, especially in the Santa Monica, San Gabriel and San Bernardino Mountains have burned extensively with many areas having burned three or more times. The maps compiled by Sayer, Brown and Brown (1981), upon which this map was based, are being submitted under a separate cover. Table 3.8 lists the major fires in this region.

C. Data Search and Retrieval Efforts

C.1 Technical Approach

Data were collected from a number of governmental and public organizations. Previous reports and documents on similar topics were located and examined as part of the literature search. These documents often contained or referred to data, whose original sources were noted. An important source during the initial stages were the notes and documents collected by Brent Taylor during the Sediment Management project at the Environmental Quality Laboratory (EQL), Caltech. Government and public agencies were then contacted, and in many cases visited. The following is a general description of data sources relevant to the South Coast Region.

Los Angeles County Department of Public Works (formerly Flood Control District).

The data available at this agency include:

Precipitation data, with both hourly and the original charts or punch tape from recording gages;
Streamflow data, with both daily and charts or punch tape from recording gages;
Debris data, including hand entered tables of the quantities of debris stored and removed from debris basins;
Fire history, including topographic maps with outlines and dates of fires from about 1910 and fire reports on recent fires (older fire reports are archived).
Streamflow and precipitation data are on microfilm up to 1977. The most recent publication covers the 1975-77 period.
People contacted include:
John Mitchell, Head, Operations Section (213) 226-4190
Don Carpenter (rainfall), Hadi Nourzi (fires, debris) (213) 226-4184
Tom Alexander (fires, debris), Ed Dingman (streamflow).
Eric Bredehorst (flood frequency) (213) 226-4089
Bob Sarasua (streamflow records (213) 226-4179

Orange County Environmental Management Agency

The data sources at this agency include:

Precipitation data with both hourly tabulations and charts from recording gages;
Streamflow data, with both daily tabulations and charts from recording gages;
Debris data are limited, but a new program on the San Diego Creek is starting;
Sediment data are collected in conjunction with the U.S.G.S.
In a new program just starting, the agency will collect its own data. The sediment data are on a computer data base.

The most recent publication covers the 1982-1983 season.
People contacted include:
Emmett Franklin (streamflow, precipitation)
(714) 634-7473
Bob Collicott (sediment, water quality) (714) 634-7463
Tom Rossmiller, Bruce Moore (sediment, water quality)
Dale Dillon (debris, channel cleanouts) (714) 634-7424

San Bernardino County Environmental Public Works Agency, Department of Flood Control and Transportation.

Relevant data include:

Precipitation data, with both hourly data (tabulated) and charts available. These data are presently being put on a computer data base, and some are available in electronic form as well.
Fire maps are kept, with fires located on topographic maps.
The most recent publication covers the 1974-76 seasons.
People contacted include:
Art Luther (Asst. Chief, Water Resources Division) (714) 383-2329
Peter J. Rusher (Sr. Hydrologist) (714) 383-2926

Riverside County Flood Control and Water Conservation District

Relevant data at this agency include:

Precipitation data, with both hourly (tabulated) and charts from recording gages available. In addition, most data are on a computer data base and are available in printouts and electronic form.
Debris and sedimentation data are limited, since the county has few debris basins.
The most recent publication covers the 1979-81 seasons.
People contacted include:
Kathy Carter (Hydrology) (714) 787-1264
Tom Clem (Hydrology) (714) 787-1264
Eric Geibersen (Dams, debris basins) (714) 787-2015

U.S. Geological Survey

Data available from this agency include:

Streamflow, with daily and monthly flows, peak flows and storm hydrographs available.
Sediment, with data available in published reports. Unpublished data are also available at the Laguna Niguel office.
Data are in reports (Water-Supply Papers and, more recently, Water Resources Data) and in electronic form at the Sacramento District Office, where a data base (WATSTORE) is maintained.
People contacted include:
Dave Sheets (Santa Barbara Office) (805) 962-8114

Bill Brown (Menlo Park Office) (415) 856-7112
Chris McConaughy (Laguna Niguel Office) (714) 643-4232
John Beck (Sacramento Office, Water Resources Data) (916) 484-4830

U.S. Forest Service

Data available from this agency include:

Fire history with fire maps available for fires in the National Forests; Sedimentation and Erosion data from the San Dimas Experimental Forest. These data include pre-and post-fire runoff measurements from both natural and controlled burns, water repellency data, vegetation and soils information. For information in this area, contact the Pacific Southwest Forest and Range Experiment Station, Riverside.
People contacted include:
Wade Wells (714) 351-6515, PSWF&R
Charles Colver (818) 684-0350, San Dimas Experimental Forest
Carol Keniflit (714) 351-6555, PSWF&R
Bob Blecker, Los Padres National Forest, Goleta, CA (805) 683-6711

California Department of Water Resources

Data from this agency include:

Streamflow, with data available in the Water Data Information System (WDIS). Data are available on microfiche (least expensive) and electronic form.
Precipitation, also available on WDIS.
People contacted include:
Bill Mork, State Climatologist (916) 445-5800

Environmental Quality Laboratory, California Institute of Technology

Data from the sediment management project are archived. Data readily available include maps of vegetation cover, debris basins, and fire history.
People contacted include:
Dr. Robert C. Y. Koh (Keck Laboratory) (818) 356-4400
Prof. Norman H. Brooks (presently on sabbatical leave)
Theresa Fall (EQL) (818) 356-6420

Other individuals contacted include:

Gerald Kuhn, Scripps Institution of Oceanography, Storm History (619) 452-4856

Prof. Gary Griggs, University of California, Santa Cruz (Coastal Storm History) (408) 429-2403

There are several reference libraries in the South Coast Region which are

extremely helpful. These include:

University of California, Water Resources Archives, Beth Willard, Librarian (213) 825-7734

This reference library has an extensive collection of publications, manuscripts and material relevant to this study. There is a large collection of uncataloged documents from local agencies as well. In addition, material not available at the UCLA Water Resources Archives can usually be obtained from Berkeley through UCLA. Sources are well cataloged and easy to find.

California Department of Water Resources, Southern Division, Los Angeles

The records and documents section combine an extensive collection of California State publications. In addition, there is a large collection of relevant documents and publications from local and federal agencies, including the County Flood Control Agencies. Sources are well cataloged and easy to find.

California Institute of Technology Libraries

Extensive collection of relevant journals and some federal and state publications. The best sources are the Environmental Engineering Library, Keck Laboratory, and the Engineering Library (Millikin Libraries). Unfortunately, the collections are spread out over several buildings and a certain amount of searching is often required.

University of California, Los Angeles Engineering Library and Geology Library

These two libraries have extensive collections of relevant journals. The Engineering Library has vast holdings of Weather Bureau/Weather Service publications. The geology library has all relevant U.S. Geological Survey Water-Supply Papers (as do the Water Resources Archives, where they cannot be checked out) and other U.S.G.S. publications. Both are excellent sources for reference material.

U.S. Army, Corps of Engineers, Los Angeles District Library

This library has most Corps of Engineers publications, including Beach Erosion Board and CERC publications. Some publications from local and state agencies are also available, as are some U.S.G.S. Water-Supply Papers. References are often miscataloged and difficult to find.

Southern California Metropolitan Water District

The reference library has (in theory) all MWD publications, although relevant ones often seem to be missing. In addition, there is a good collection of California Department of Water Resources publications.

C.2 Hydrologic Data Available

Tables 3.9 and 3.10 can be used as quick references for stream gages of interest in this area. More detailed information is included in Appendix B.

C.2.1 Los Angeles and San Gabriel Rivers

These two rivers have been gauged near the ocean outlets since 1928 by the Los Angeles County Flood Control District (now Department of Public Works, Hydraulic Division). Recent annual data, not available in publications (which stop in 1977), have been obtained as part of this study and are included in Appendix B. Note that in order to determine the flow to the ocean from the San Gabriel River, flow from Coyote Creek must be added. Data are available for these streams from 1928, but a large portion of the Coyote Creek watershed was not gauged until 1963.

Data from this agency are available in tabular form on a daily and monthly basis and until recently, on a cooperative basis from the U.S.G.S. Pre-1978 data are available on microfilm; this includes both strip charts from recording gages and tabular data. Charts and digitized tape from gages are also available.

Early data from the U.S.G.S. are available for these rivers, but only a fraction of the watersheds were gauged. Rainfall data could be used to estimate runoff from south of Azusa for the San Gabriel River; this estimate could then be combined with station 11-0835 to obtain data from 1894 to 1928. By adding several stations and estimating runoff downstream, Los Angeles River data could be estimated from 1918 to 1928, but this would require much more effort than on the San Gabriel River, and would only add ten years to the record.

Periodic sediment samples have been made on the Los Angeles River since 1975, but the data are limited to a few days per year (often less than once per month). These data are available from U.S.G.S. publications, and the original, unprocessed data are available from the Laguna Niguel Office (Chris McConaughy). Streamflow data are also available from this office, including charts and digitized tape from recording gages. The U.S.G.S. maintains a computer data file (watstore) of all daily measurements in the Sacramento office (John Beck).

C.2.2 Santa Ana River

This river has been gauged since 1923 by the U.S.G.S. Portions of the river in the upper reaches have been gauged since 1896, but upstream stations in this river are unreliable indicators of downstream flow because of diversions and substantial losses to groundwater. As pointed out by Taylor (1981), there is usually a substantial difference in the flow measured at Santa Ana and the flow released from Prado Dam.

Sediment data from the U.S.G.S. are also available for the Santa Ana River.

Periodic measurements have been made since 1967, and daily measurements have been made from 1967 to 1971, 1977 to 1980 and in 1982. Both sediment and flow data are available from U.S.G.S. publications and from the computer data system in the Sacramento office (John Beck). These data can be obtained by specifying the station and period of record. In addition, charts and digitized tape from recording gages as well as the original sediment data are available from the Laguna Niguel office (Chris McConaughy).

C.2.3 Santa Monica Mountain Group

The few stream gage stations in this stream group are operated by the Los Angeles County Department of Public Works (formerly Flood Control District). The most important streams in terms of area are Malibu and Topanga Creeks, which have records from 1930. Ballona Creek, which now primarily carries urban runoff, is also gauged, but the Sawtelle-Westwood Channel must be combined to obtain the flow to the ocean. Daily flow data are available from the Department of Public Works in tabular form. Data prior to 1978 are available on microfilm; these data include charts from stream gages and tabular data. Original charts and digitized tapes from stream gages are available as well. Data can be obtained by specifying the period of record and station.

There have been no sediment measurements made on these streams.

Because of a legal matter, all data from gages between Malibu Creek and Topanga Canyon, from the shoreline to the top of the watershed, inclusive, are unavailable without prior permission from the Los Angeles County District Attorney (John Mitchell, 1985 personal communication).

C.2.4 Laguna Hills Group

The principal streams in this group include San Diego Creek and Aliso Creek. San Diego Creek is gauged by the U.S.G.S. Flow data are available on this creek from 1949, and daily sediment measurements have been made since 1972. These data are available in U.S.G.S. publications, and from the computer data system at Sacramento. The original data are archived at Laguna Niguel.

Other streams in this region are gauged by the Orange County Environmental Management Agency, and are listed in Table 3.9 and in Appendix B. Daily flow data and original charts from gages are available from this agency. At the present time, an extensive sediment study on the San Diego Creek is in the initial stages. This work is being carried out cooperatively with the U.S.G.S.

C.2.5 Debris Basin Measurements

Although debris basins exist in all four counties in this region, only Los Angeles County maintains debris basin data on a regular basis. A list of these debris basins and the total amount of sediment removed, updated through 1984, is

provided in Appendix B. In addition to these data, records are kept on each basin cleanout.

The Los Angeles County Department of Public Works also makes regular surveys of reservoirs under their jurisdiction, and tabulates capacities, and quantities of sediment excavated or sluiced. These data are also available in tabular form, along with summaries for each reservoir.

A study entitled "Debris Quality Study" (July, 1974) was conducted by this same agency during which particle size distributions of debris in some thirty debris basins were made. These data are also available.

Orange County has only a few debris basins, and only a few measurements have been made on cleanouts at one basin. These data are being submitted under a separate cover.

C.2.6 Forest Fires

Los Angeles County Department of Public Works, Hydraulic Division maintains an excellent set of fire maps, dating back to 1915. In addition, fire reports are kept which contain details on the fire and the surrounding area. Details include possible effects and remedial action taken.

San Bernardino County Flood Control and Water Conservation District also maintains fire maps; copies are being provided under a separate cover.

The most extensive treatment of fire history for this region was done by Wells (1982). Copies of the fire maps produced for this study (Caltech Sediment Management Study) are being provided under a separate cover.

C.2.7 Frequency Analyses

Frequency analysis based on peak flows has been conducted by the Los Angeles County Department of Public Works (Eric Bredehorst). These analyses are at best ten years old, and are based on peak annual flows, not on volume. The analyses cover most streams in the region, with the exception of the Santa Ana River basin.

Frequency analyses based on peak flows and volume for the Santa Ana River were conducted by the Army Corps of Engineers (Santa Ana River, Phase 1 GDM, 1980).

C.2.8 Other Pertinent Data

Kolker (1982) has studied and compiled data on debris basin and gravel mining in this region. Additional data are available from the U.S. Bureau of

Mines Mineral Yearbook; other data are available from Evans et al (1977). Plate 3.1 shows sand and gravel mines in the region.

Estimates of sediment yield from the three major rivers in this region were made by Taylor (1981). For the Los Angeles and San Gabriel Rivers, beach surveys were his primary data sources. These surveys were made periodically from 1937 to 1962 and the data are available at the Los Angeles County Department of Public Works, Hydraulic Division, in a series of reports entitled "San Gabriel River Volumetric Changes Along Shore Adjacent to Outlet, 1937-(Year)."

Hydrographs of storm events are available in a variety of reports (Waananen, [1969], Wahl et al [1980], Ventura County [1969], Los Angeles County Flood Control District [1969, 1983], Burke [1938, 1952, 1956], Laverty [1943]). However, the earlier hydrographs tend to be either inflow/outflow hydrographs at dams (in the case of Los Angeles Flood Control District reports), or of a scale difficult to use for study purposes. Since the original data are almost always available, these would be the data of preference. The major rivers have long historical records of discharge near the coast (pre-1930), and either the strip charts from the recording gages or, more recently, the digitized tapes from recording gages are archived (at the Los Angeles County Department of Public Works, the U.S. Geological Survey or Orange Country Environmental Management Agency.) An example of a strip chart is shown in Appendix B. (Note the pen reversal at the flood peak in this case.) In general, these data must be reduced (using calibration curves, also available from the agencies) to produce stage or discharge hydrographs. Unless the recorder was damaged (or in some cases destroyed) during a flood, these data can be obtained by specifying the dates and gages desired.

D. Data Gaps and Limitations

The area with the most serious data problems is that of sediment measurements. Except for the Santa Ana River, and San Diego Creek, there are few measurements in this region. Data are needed in the major streams draining the Santa Monica Mountains, and in the Los Angeles and San Gabriel Rivers. There are insufficient data in these important streams to assess accurately sediment delivery to the coast.

Although there are peak flow-frequency studies available, there have been few volume-frequency studies. The data with which these studies could be made (including annual volume, monthly average flow and annual peak flow) are readily available, both from the U.S.G.S. (Sacramento office) and from the local agencies.

The major rivers and most major streams have been gauged for more than 50 years at or near the ocean outlets, so the historic record is good. The records can be extended in some cases, using rainfall data and runoff models, which could yield flow estimates dating back to the turn of the century. Where data gaps occur in recent records (usually during very high flows) estimates have usually been made by the agencies collecting the data.

A fire frequency analysis needs to be carried out for the San Gabriel, San Bernardino and Santa Ana Mountains. A study of this sort could probably be carried out in conjunction with the U.S. Forest Service.

While there are a number of studies on debris basins (Rowe et al., 1954; Ruby, 1973; Sinclair and Hamilton, 1954), and sediment accumulations in debris basins and reservoirs are well documented, the lack of data on coastal sediment delivery makes the relative effects of control structures difficult to assess. This points out again the need for additional sediment measurements.

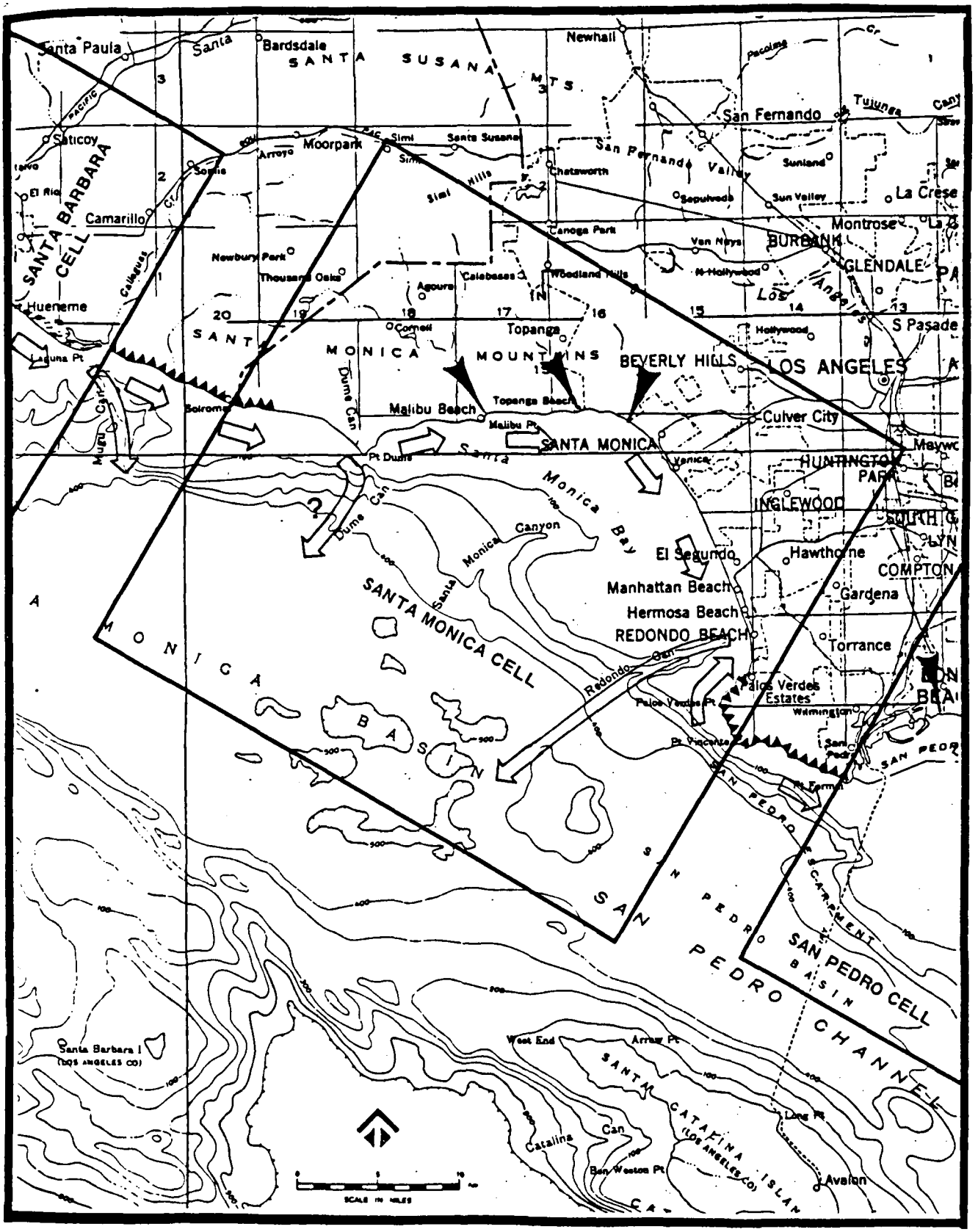

Figure 3.1 South Coast Region

Source: Calif. DNOD Atlas of Shoreline Erosion

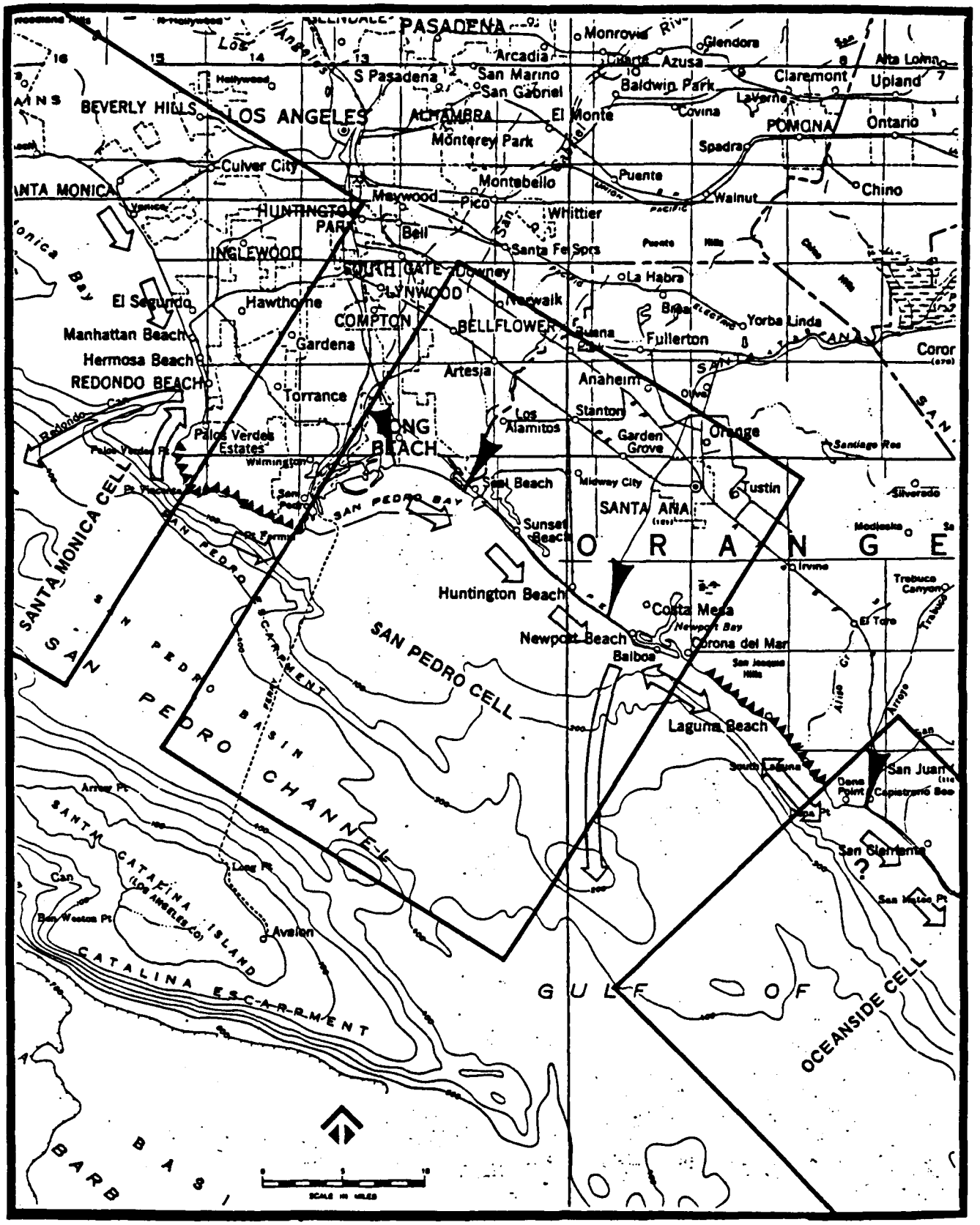

Figure 3.2 South Coast Region

Source: Calif. DNOD Atlas of Shoreline Erosion

TABLE 3.1

Drainage Areas in the South Coast Region

Basin or Group	Littoral Cell	Drainage Area mi^2	Controlled Area mi^2	Percent Controlled
Santa Monica Mtn Grp	Santa Monica	417	64	15
Los Angeles River	San Pedro	830	334	40
San Gabriel River	San Pedro	640	537	84
Santa Ana River	San Pedro	1700	1525	90
Laguna Hills Group	S. San Pedro Ranch	200	--	--
		3787	2460	65

Source: Brownlie and Taylor (1981)

Table 3.2

Major River Features in the South Coast Region

Name	Length mi	Maximum elevation ft.	Slope range	Remarks
Los Angeles R	55	6900	0.003-0.04	Heavily controlled, channelized
San Gabriel R	55	1000	0.003-0.05	Heavily controlled, channelized
Santa Ana River	100	11500	0.003-0.05	Heavily controlled

Table 3.3

Precipitation at Selected Stations, South Coast Region

Location ΓRW no.	Elevation ft	Precipitation inches average	maximum	minimum	Years of Record	Latitude / Longitude
Santa Monica 7950-00	66	14.4	32.4	6.3	47	34-00-43 118-29-27
Los Angeles 5115-00	269	15.1	32.5	4.92	108	34-03-10 118-14-13
Pasadena 6719-00	862	20.0	46.4	7.3	98	34-08-54 118-08-36
Opids Camp 6465-00	4752	38.9	89.1	13.9	47	34-15-18 118-05-41
Hoegees FC 4017-00	2650	37.2	80.5	13.7	52	34-12-30 118-02-00
Palos Verdes 6663-01	1276	12.8	28.4	3.5	29	34-46-43 118-20-36
Zuma Cyn 9990-11	1500	26.2	57.5	9.1	43	34-05-58 118-49-38
Santa Ana 7888-01	124	13.0	32.1	3.6	70	33-45-05 117-52-11
San Bernardino 7723-00	1125	16.7	42.9	6.0	110	34-07-40 117-16-00
Big Bear Lake 0742-00	6814	34.3	86.9	11.1	34	34-14-29 116-58-29

Source: Calif DWR Bulletin 230-81

Table 3.4

Mean Monthly Precipitation at Selected Stations, South Coast Region, inches

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Santa Monica	3.0	7.8	2.1	1.3	.09	.03	.03	.06	0.8	0.3	2.0	2.3
Los Angeles	3.0	2.8	2.2	1.3	0.1	.03	0.	.04	0.2	0.3	2.0	2.2
Pasadena	4.0	3.8	2.7	1.8	0.3	0.1	.01	.06	0.2	0.4	2.7	2.8
Hoegees FC	7.4	7.0	5.1	3.7	0.6	0.2	.04	0.1	0.3	0.8	4.9	5.7
Palos Verdes	2.3	2.3	1.7	1.0	0.1	.04	0.	0.	.08	0.2	1.6	1.7
Santa Ana	2.6	2.5	2.0	1.3	0.2	.03	.02	.04	0.1	0.3	1.7	2.2
San Bernardino	3.1	2.9	2.5	1.6	0.5	0.1	.04	0.1	0.3	0.5	1.9	2.6
Big Bear Lake	5.9	5.2	5.6	3.6	0.8	.06	0.7	0.7	0.6	1.0	4.7	5.8

Source: Goodridge (1981a)

TABLE 3.5

Major Control Structures in the South Coast Region

Name	Watershed	Drainage Area mi^2	Year completed	Remarks
Malibu Res	Malibu Creek	64	1923	
Lake Sherwood	Malibu Creek	16.1	1904	Upstream of Malibu Res
Devil's Gate Res	Los Angeles R	29.7	1920	
Hansen Dam	Los Angeles R	780	1940	
Big Tujunga Res	Los Angeles R	82	1931	Upstream of Hansen Dam
Pacoima Dam	Los Angeles R	73.5	1925	
Sepulveda	Los Angeles R	152	1941	
Puddingstone	San Gabriel R	33.1	1928	
Live Oak	San Gabriel R	0.2	1975	Upstream of Puddingstone
San Dimas	San Gabriel R	15.9	1922	
Big Dalton	San Gabriel R	4.3	1929	
Santa Fe Basin	San Gabriel R	236	1949	
Morris Res	San Gabriel R	210	1935	
San Gabriel Res	San Gabriel R	205	1938	
Cogswell	San Gabriel R	41	1935	
Thompson Dam	San Gabriel R	3.5	1928	
Eaton Dam	Rio Hondo (San Gabriel R)	9.5	1936	
Santa Anita Dam	Rio Hondo (San Gabriel R)	12.5	1960	
Whittier Narrows	San Gabriel R Los Angeles R	554	1957	Downstream of San Gabriel R controls above.
Fullerton Dam	Coyote Cr (San Gabriel R)	5.0	1941	

(continued on next page)

TABLE 3.5

Major Control Structures in the South Coast Region
(continued)

Name	Watershed	Drainage Area mi²	Year completed	Remarks
Brea Dam	Coyote Cr	27.0	1942	
San Antonio Res	Santa Ana R	110	1956	
Lake Mathews	Santa Ana R	40	1938	
Prado	Santa Ana R	2230	1941	Downstream of above Santa Ana R controls.
Santiago Res		63.1	1930	Upstream of Villa Park.
Villa Park Dam		83.4	1963	

Source: DWR Bull. 17-84

TABLE 3.6

Streamflow and Sediment Delivery, South Coast Region

River Streams	Ave Flow cfs	Max Flow cfs - year	Sediment ave 1000 tons/yr	Sediment daily max 1000 tons/day - year
Los Angeles River	199	129000 - 1980	400 eq	N.A.
San Gabriel R includes Coyote Cr	55	30200 - 1938		N.A.
Santa Ana R 1924-40 1940-82	23.4	46300 - 1938	280 eq	2670 - 1969

Sources: U.S.G.S. Water-Supply Papers
Brownlie and Taylor (1981)

TABLE 3.7

Peak Flows (CFS) During Major Floods, South Coast Region

Stream	Year 1938	1943	1952	1969	1978	1980	1983	U.S.G.S. gage	Drainage area
Los Angeles R	99000	37900	47800	102000	52700	128000	81800	11-1030.	827
San Gabriel R	23000	14600	N.A.	11700	4780	11000	13400	11-0880.	471
Santa Ana R	46300	4400	3790	19100	16100	16100	N.A.	11-0780.	1700

Source: U.S.G.S. Water-Supply Papers
U.S.G.S. Water Resources Data for California

TABLE 3.8

Major Forest Fires, South Coast Region 1910-1975

Year	M/Day	Location	Watershed	Area Burned (acres)
1911?-1915	N.A.	West Fork, San Gabriel River	San Gabriel R	19000
1914	N.A.	Santiago Res	Santa Ana R	14300
1919	9/	Little Dalton Cyn, San Gabriel Mtns	San Gabriel R	54600
1919	10/	Pacoima Cyn	Los Angeles,	72500**
1922	N.A.	Arrowhead Lake	Santa Ana R	21000
1924	8/	N. of Glendora West Fork, San Gabriel R	San Gabriel R	41390
1928	N.A.	Red Mtn., Wilson Cr	Elsinore Lake Santa Margarita R	57700*
1935	10/	Santa Monica Mtns	Santa Monica Mtns	31400
1938	11/	Santa Monica Mtns	Topanga Cyn Mandeville Cyn	15000
1939	N.A.	Arrowhead Pk	Santa Ana R	13900
1943	11/	Santa Monica Mtns	Santa Monica Mtns	13000
1953	N.A.	N. of Sierra Madre	San Gabriel V	13300
1953	N.A.	Fish Fork	San Gabriel R	22300
1956	11/19	E. of Arrowhead	Santa Ana R	14500
1957	N.A.	West Fork	San Gabriel R	26400
1959	N.A.	Big Tujunga	Los Angeles R	13100
1960	N.A.	San Gabriel Res	San Gabriel R	13600
1960	N.A.	San Dimas Forest	San Gabriel	22100
1967	10/29	Santiago Res	Santa Ana R	45200*

(Continued on Next Page)

TABLE 3.8

Major Forest Fires, South Coast Region 1910-1975
(Continued)

Year	M/Day	Location	Watershed	Area Burned (acres)
1967	10/15	Thousand Oaks	Santa Monica Mtns Calleguas Cr	26900**
1968		Above Glendora	San Gabriel R	18700
1970		Malibu Cyn	Malibu Cr, Santa Monica Mtns	115500**
1970	9/25	Santa Monica Mtns Santa Susana Mtns	Santa Monica Mtns, Los Angeles R, Santa Clara R, Calleyuas Cr	38400
1970	9/28	Cucamonga Pk	Santa Ana R	38400
1970	11/13	Constance Pk Harrison Mtns	Santa Ana R	55200
1973	9/26	Sycamore Cyn	Santa Monica Mtns	11500
1975	N.A.	Sunset Peak	San Gabriel R	21500
1975		Tujunga Cyn	Los Angeles R	53600

Source: Caltech EQL Fire Maps, Wells (1982)

*Includes area burned in San Diego Region.

**Includes area burned in South Central Region.

TABLE 3.9 GAGES ON MINOR STREAMS, SOUTH COAST REGION

STREAM	AGENCY	PERIOD OF RECORD	TYPE	USGS #	OTHER #	REMARKS
Arroyo Sequit.	LAC	1953-	R	11-1056.50		
Sycamore Canyon	USGS	1970-	R	11-1057.00	(DWR) Z5-7800	
Malibu Cr.	LAC	1931-	R	11-1059.00	F - 130R	
Topanga Cr.	LAC	1930-	R	11-1040.00	F - 54BR	
Santa Monica Cr.	LAC	1931-	R	11-1038.45	(DWR) Z5-6050	
Ballona Cr.	LAC	1928	R	11-1035.00 11-1035.10 11-1036.20	F - 38C - R	Combine 11-1035.00 and 11-1035.30 for 1951-
Sawtelle-Westwood	LAC	1951	R	11-1035.30	F - 301 - R	
Dominguez Ch.	LAC	1938	R	11-1031.60	F - 265 - R	
Los Cerritos Ch.	LAC	1949-	R	11-0917.50 11-0917.40	F - 279 GR	
San Diego Cr.	USGS	1949-	R	11-0485.00 11-0485.55	(DWR) 41-3200 (DWR) 41-3100	
Laguna Cyn.	OCEMA	1971-	R	---	(OC) 222	
Aliso Cr.	OCEMA	1930-		11-0475.00	(OC) 4	

Note: For latitude, longitude and drainage areas of these and other gages in the South Coast Region see Appendix B.

R = recording gage

TABLE 3.10 GAGES ON MAJOR STREAMS, SOUTH COAST REGION

STATION	AGENCY	PERIOD OF RECORD	TYPE	USGS #	OTHER #	REMARKS
Santa Ana River	USGS	1923-	R	11-07780.00	(DWR) 41-1100	Sediment measurements 1967-1971, 1977-1980, 1981-1982
San Gabriel River	LAC	1928-	R	11-0880.00	F - 42 BR	Combine with Coyote Creek
Coyote Creek	LAC	1928-.930	R	11-0905.50		Combine with San
	LAC	1930-1963	R	11-0905.00		Gabriel River
	LAC	1963-	R	11-0907.00	F - 354 R	above
Los Angeles River	LAC	1928-	R	11-1030.00	F - 319 R	(Also F - 36 R, F - 180 R)

See note, Table 3.9

R = recording gage

4.0 SOUTH CENTRAL REGION

The South Central Region includes portions of San Luis Obispo, Santa Barbara, Ventura and Los Angeles Counties. The extent of the South Central Region is defined by watersheds draining to the Morro Bay Cell, which extends from ragged Point to Point Buchon, the South Morro Bay Reach, which extends from Point Buchon to Point San Luis, the Santa Maria River Cell, which extends from Point San Luis to Point Sal, the South Santa Maria Reach, the Santa Ynez River Cell, which extends form about four miles south of Point Sal to Point Arguello, the Santa Barbara Cell, which extends from Point Arguello to the Mugu Submarine Canyon off of Calleguas Creek, and the South Santa Barbara Reach, which extends from the Mugu Canyon to Solromar. The littoral cells correspond to those defined in the Assessment and Atlas of Shoreline Erosion Along the California Coast (July 1977) and are shown in Figures 4.1, 4.2 and 4.3, taken from this document. The following sections give general hydrologic information regarding the watersheds draining into these regions.

A. Drainage Areas

A.1 Drainage Areas and Sub-Areas

The South Central Region has four major river basins, three creek basins and two drainage groups. The river basins are those of the Santa Clara, Ventura, Santa Ynez and Santa Maria Rivers; and the creek basins are those of the Calleguas, San Antonio (Santa Barbara County) and Arroyo Grande Creeks. In addition, there are the Santa Ynez Mountains and the Morro Bay stream groups. These regions are shown on Plate 4.1 and pertinent features are shown in Table 4.1.

The Morro Bay Group drains to the coast largely from the Santa Lucia Mountains, which parallel the coast. Important sub-areas include the Arroyo de la Cruz basin in the north, the San Luis Obispo Creek basin in the south, and the Chorro Creek and Los Osos Creek basins, which drain to Morro Bay.

The Arroyo Grande Creek basin is in large part controlled by Lopez Dam. This basin has large mud flats along the coast.

The Santa Maria River basin has two major sub-basins. The Cuyama River sub-basin, which includes sixty percent of the Santa Maria River basin, is controlled by Twitchell Dam. The other major sub-area drains to the Sisquoc River.

The Santa Ynez River Basin is controlled by Cachuma Lake and upstream by Gibraltar and Juncal dams. The basin can be divided into two sub-basins, one upstream of Cachuma Lake, the other downstream.

The Santa Ynez Mountains Group drains largely from the Santa Ynez Mountains to the southern facing coast. The western half of the group is composed of numerous creeks draining from small canyons. In the Santa Barbara - Goleta area, important sub-areas include the basins draining to the Goleta Slough (Atascadero, San Jose, Los Carneros Creeks), and the Arroyo Burro and Mission creeks. In the eastern portion of the group, important drainage areas include Franklin and Carpenteria Creeks.

The Ventura River basin is a relatively small drainage basin, and is partly controlled by Lake Casitas and Matilija Reservoir. Major sub-areas include the San Antonio Creek (Ventura County) basin and the Matilija-Coyote Creek basin.

The Santa Clara River basin is a large basin draining the Transverse Ranges in the northern portions of Ventura and Los Angeles Counties. The major sub-areas include the four basins of the Castaic, Piru, Sespe and Santa Paula Creeks. Of these, Castaic Creek and Piru Creek are controlled by Castaic Reservoir and Lake Piru. In addition, a small portion of the basin is controlled by Bouquet Reservoir.

South of the Santa Clara River basin lies the Calleguas Creek basin. The major sub-area of this basin is the Conejo Creek sub-basin.

A.2 Physiography and Topography

The watersheds draining to the South Central Coast Region are separated into two distinct regions. In the north, the coast runs northwest, and the drainage area is bounded by the Santa Lucia Mountains and the Caliente Range. South of Point Conception, the coast runs generally east-west and the watersheds are bounded on the north by the San Andreas Rift Zone, and on the east by the San Gabriel and Santa Susana Mountains. Other important ranges in the region include the Santa Ynez Mountains, the San Rafael Mountains and the Sierra Madre Mountains. Table 4.2 presents some of the main characteristics of the major basins in the region. The following discussion gives some particular features.

The Morro Bay Group is composed of a series of small streams rising from the coast to the Santa Lucia Coastal Range. The streams are typically short and steep. Typical lengths are on the order of 25 miles, and average slopes range form 0.02 on the Arroyo de la Cruz to as high as 0.08.

The Arroyo Grande Creek rises slowly from the ocean to Lake Lopez. Above the lake, the tributaries rise steeply into the surrounding mountainous area, with elevations as high as 3100 feet. The southern portion of the basin is flat with extensive sand dunes and mud flats on the coast.

The San Antonio Creek Group is a small, moderately sloped basin with terraces along the valley. Sand dunes are the most conspicuous feature of the coastal terraces, and extend as far as four miles inland. Dune movement is generally inland, due to the prevailing winds.

The Santa Maria River basin drains the Caliente, Sierra Madre and San Rafael Mountains. The two main tributaries are the 108 mile long Cuyama River and the 50 mile Sisquoc River. The Cuyama River is somewhat unique for this region as the terrain is markedly different from other watersheds. The northern portion is known as the "Cuyama Badlands" and is semi-barren, rugged terrain, in contrast to the chaparral covered mountains which typify the rest of the region.

The Santa Ynez River drains the Santa Ynez and San Rafael Mountains. Like the Santa Maria River system, the Santa Ynez River is a long, moderately sloped river running through rugged terrain. The Santa Ynez River is characterized by numerous tributaries of 10 to 20 miles in length along its relatively straight path between the Santa Ynez and San Rafael Mountains. Gradients of the tributaries reach 50% in some places. Elevations in the basin reach 6500 feet in the rugged San Rafael Mountains.

The Santa Ynez Mountains Group drains the southern face of the Santa Ynez Mountains. The mountains run east-west along the coast, and are extremely steep in places, with slopes in some canyons near vertical. The highest elevations in the mountains are on the order of 4000 feet, and most streams are short and run directly down canyons to the ocean.

Two important saltmarshes exist in the area: El Estero, in Carpenteria,

and the Goleta Slough, which was a small harbor until it silted up during the 1862 flood (Kuhn 1985 personal communication).

The Ventura River is a relatively short, steep river covering a small area on the west ends of the Santa Ynez and San Rafael Mountain Ranges. The slope of the river varies from 0.01 to over 0.05 in the upper reaches.

The Santa Clara River basin drains the Transverse Ranges and has its source in Soledad Canyon, Los Angeles County. The river has four large tributaries: Castaic, Piru, Sespe and Santa Paula Creeks. The lower half of the river flows over a broad alluvial plain, while the headlands are in steep, rugged territory. The maximum elevation is found at Mount Piños, 8831 feet, in the Piru Creek watershed.

A.3 Climate

While the South Central Region is generally classified as having a Mediterranean Dry-Summer Subtropical climate, the climate in fact varies considerably due to topographic effects. North of Point Conception, the coast and coastal mountain ranges run in a northwesterly direction; south of Point Conception, they run in an east-west direction. Because of the typical storm approach and the typical northwest wind pattern, the two regions exhibit somewhat different climatic features.

Along the coast, the temperatures are controlled by the cool ocean temperatures, and the temperature range is small. Average winter temperatures are 52°F all along the coast, and average summer temperatures run form 69°F in the south to 65°F in the north. Inland, however, there are greater variations. In the Santa Maria River watershed, it is usually hot and dry inland in the summer, and much colder temperatures are found in winter. As much as ten feet of snow falls at higher elevations. Hot, dry summers are typical in all the inland valley areas. Table 4.3 shows average precipitation patterns in this region.

In general, strong orographic effects are evident with annual precipitation of 30 to 40 inches in the higher elevations. However, in the Cuyama River watershed, one finds reduced rainfall even at high elevations (Ozena, Table 4.3). This area lies behind the barrier of the Sierra Madre Range ("behind" in that it is in the lee, with respect to prevailing winds and typical storm tracks), and as a result the region has a low annual precipitation average. The semi-barren land in this area is referred to as the "Cuyama Badlands".

Seasonal variations are shown in Table 4.4, where it is seen that most precipitation occurs in the winter months, with summers generally very dry. Although there is occasional thunderstorm activity in the mountain areas in summer, it is generally much less intense and of shorter duration than in the South Coast and San Diego mountain areas.

An important climatic feature of the region is the foehn, or Santa Ana, winds which can occur at any time of the year. These warm, dry winds originate

from a high-pressure center over the Great Basin, often a day or so after the passage of a cold front, and can produce conditions which result in extreme fire danger.

A.4 Soils and Vegetation in the South Central Region

Seventy percent of the South Central Region lies within the watersheds of the Santa Clara, Santa Maria and Santa Ynez Rivers. A large fraction of these watersheds (39% of the Santa Ynez watershed, 49% of the Santa Maria watershed) belongs to the National Forests, and are thus highly undeveloped. The vegetation in these regions is largely natural.

The most important vegetation type in this region is chaparral. It is both an efficient watershed protector and slope stabilizer, and is extremely susceptible to fire. Chaparral plants are evergreen, sclerophyll shrubs with extremely strong root systems. The plants are well adapted to steep, rugged terrain, as they form deep, extensive root systems. This strong root systems makes them a valued watershed protector.

However, chaparral plants are among the most flammable plants known (Wells 1982), and have the characteristic that as much as 50 percent of their biomass may be dead after 30 years. This makes chaparral areas, particularly older areas, susceptible to fire, which denudes the steep mountain sides of their protection from erosion.

Chaparral covers over 70% the upland Santa Ynez watershed and 32% of the Santa Maria watershed. In addition, chaparral is predominant along the Santa Ynez Mountains and in the uplands portion of the Santa Clara River watershed, except at the highest elevations, where coniferous forests exist.

West of Santa Barbara, the coastal areas are predominantly grass lands and shrubs, with coastal sage and chaparral in the higher elevations. Large areas of what were once coastal grasslands are now agriculturally developed, especially in the Santa Maria and San Luis Obispo areas. One region which deviates from the "coastal grasslands, upland chaparral" character which typifies most of the region is the semi-barren region of the Cuyama Badlands.

The soils vary in this region as well. In the Cuyama Badlands area there are residual soils on poorly consolidated sediments. Chaparral areas generally have light to medium soils of moderate thickness, except in very steep areas which have shallow to no soil with rock outcrops. Valleys tend to have coarse alluvium. The Santa Clara River has very coarse debris in the headlands, a result of the fracturing caused by the San Andreas fault zone. Downstream, the river passes over much finer, non-marine sediments, before arriving on an alluviated lowland.

Of considerable importance are the coastal sand dunes in the northern coastal areas. These dunes are found at the coastal end of the San Antonio Creek Group and the Santa Maria River watershed. The dunes extend as much as 5 miles

inland and are composed of fine to coarse quartz sand. Mature and old dunes are anchored by vegetation, whereas younger dunes migrate and support little vegetation.

There are several lagoons and coastal marshes of importance in the area. These include the Mugu Lagoon, at the terminus of Calleguas Creek, and the Goleta Slough, once a small harbor, but silted in by the flood of 1862. In the northern part of the region, there are the Oso Flaco mud flats, where the Santa Maria River terminated until the flood of 1825. These mud flats presently have little effect on sediment delivery to the coast, whereas the Goleta Slough effectively cuts off sediment from the San Jose, Atascadero and Los Carneros Creeks in Santa Barbara. Likewise, the Calleguas Creek is probably not an important source of beach sand, since much of the sediment that is able to pass through Mugu Lagoon probably ends up in the Hueneme Submarine Canyon just offshore (Brownlie, 1981).

A.5 Development and Structures Affecting Runoff

The South Central Region is largely rural with a few urban concentrations near Ventura, Santa Barbara, Lompoc, Santa Maria and San Luis Obispo. Much of the region remains part of the Los Padres and Angeles National Forests, and has remained undeveloped. Agriculture covers a significant portion of the region, especially in the lowland areas of the Santa Clara River Valley and the Santa Ynez and Santa Maria Rivers.

One result of the moderate development in the region is the system of control structures on the watersheds. Largely provided for water-supply (in contrast to the South Coast Region where flood control is a major consideration) dams control over 35% of the watersheds in the region. The major control structures as well as mines in the region are shown on Plate 4.1 and their relationship to the watercourses are shown schematically on Plate 4.2. Table 4.5 lists these controls, and presents some of their more important features.

Compared to the South Coast Region, there are relatively few debris basins in the South Central Region, and most are confined to the steep canyons draining to the Calleguas Creek and Santa Clara River. In addition, there are a number of check dams in the steep canyons of the Santa Ynez Mountains above Santa Barbara. In the northern part of the region, debris basins have been rarely built, a result of the fact that the highly erodible areas are found mostly in the National Forests away from urban areas. Three presently full debris basins do exist in the Los Padres National Forest: these were constructed after the 1964 Coyote Fire.

The effect of the controls on sediment delivery is varied, but in general the reservoirs act as sediment traps. Erosional rates are high in some areas, and reservoirs are rapidly filling with sediment, as is the case with Gibraltar Reservoir, the capacity of which was over 50% sediment by 1969 (Dalen et al. 1973). The large reservoirs in the region are designed for water-supply and therefore pass little of the sediment which enters. The effects may vary, however. Most of the Cuyama River Basins drains to Twitchell Reservoir, but due to the low rainfall in the Cuyama Badlands and the lower erodibility of this

area, the effect is not as great as would be found for a control structure downstream of a much smaller, but more erodible area such as the San Ynez River basin.

A.6 Runoff and Sediment Delivery Characteristics

As would be expected from an examination of rainfall data (Tables 4.3 and 4.4), flow in the streams of the South Central region is highly variable and intermittent. Table 4.6 shows some characteristic data for the major streams of this region, and it can be easily seen that there is a wide range of flow. Typically, peak flows are 1000 or more times the annual average, and minimum flows are zero. The year-to-year variability is also large, and the annual average is greatly influenced by a few years of very high flow. For example, the mean annual flow at the terminus of the Santa Ynez River is about 50 cfs, but the median is about 2.4 cfs. Some years, there is little or no flow, while other years the annual flow is ten times the average. Typical hydrographs for major streams are presented in Appendix C.

Sediment data are very sparse in this region, as most measurements have been made on the Ventura and Santa Clara Rivers. Some characteristics of the data that are available are summarized in Table 4.6. As is true for the discharge data, the peak one-day discharges are often many times average annual yield. Williams (1979) found that 55% of all sediment transported to the coast from 1968 to 1975 in the Santa Clara river was transported in two days, and that over 90 percent was in 53 days.

Williams (1979) also reports size distribution data for the Santa Clara River. Most suspended load is clay and silt, although during high flood flows there is a significant fraction of sand (as much as 25%). Published data on the other basins is sparse, and may not be representative. Typical size distribution are presented in Appendix C.

A.7 Forest Fires in the South Central Region

Forest fires are of extreme importance to erosional and sedimentation processes in the South Central Region. As was mentioned in Section A.4, a large fraction of the watersheds are covered with chaparral, which is among the most flammable vegetation types known. The fact that chaparral is well adapted to steep, rugged, highly erodible terrain makes "fire-flood" sequences with accompanying debris a regular occurrence.

Dalen et al. (1973) have found that erosion in the Gibraltar watershed of the Santa Ynez River has almost doubled as a result of wildfires. Their study includes both a fire frequency calculation and erosion estimates. As part of their study, they report that 3% of the fires burn 1000 acres or more, and that 98% of all acreage was burned by a few major fires. Results of their studies in tabular form are presented in Appendix C.

Blecker (1985, personal communication) reports that there have recently been fewer large fires as a result of prescribed burns. Because of the nature of chaparral, old stands of chaparral become increasingly susceptible to fire. In order to reduce the occurrence of wildfires old stands of chaparral are burned on a regular basis in late winter and spring. Since the start of the program, (the early 1970's), there have been no fires in the South Central Region of the Los Padres National Forest larger than 12000 acres (F. Cahill, 1985 personal communication).

According to Cahill's records, lightning is a factor in starting fires, particularly in the Mount Piños area at high elevation, but the fires are almost always under 2 or 3 acres. Most large fires are started accidentally or deliberately.

B. Historical Perspective

B.1 Historical Outline of Major Floods and Erosional Events

There are no historical data on floods in the South Central Region prior to 1825, and prior to 1900, there are very limited data. The years 1825, 1862 and 1884 were flood years throughout Southern California. In 1825, the Santa Maria River changed course, moving the terminus from Oso Flaco to its present location. The year 1862 produced disastrous flooding throughout California; the present location of Santa Maria became a deep lake (Forest Service Report, 1944) and much of the city of Ventura was flooded. Severe floods also occurred in 1884.

One remarkable feature of the floods is that they are often quite local. Table 4.7 presents some data on flood years that were more or less general and covered several watersheds; also noted in Table 4.7 are some local flood years. Among these are the years 1907, 1909 and 1967, in which there were severe floods. In 1907, a record flow occurred in the Santa Ynez River, and in 1909 a flow estimated to be much higher then any recorded since occurred in the Santa Maria River. The adjacent Santa Ynez River had an estimated peak flow of 23000 cfs during the same period, a high, but not extreme value. The 1967 rainstorm was quite local and caused severe flooding in Calleguas Creek and in Santa Barbara, but flows were not unusually high elsewhere.

Most early records of erosion refer to the area of agriculture land lost to a flood. Thus, one finds that 1000 acres of farming land was carried away by the 1909 flood on the Santa Maria River. The 1907 flood on the Santa Ynez River produced a 400 yard wide sand bar on the coast.

The first attempt at quantifying sediment transport in the region was probably made in the US Forest Service survey of the Santa Maria and Santa Ynez Rivers (samples were taken in 1941, using "Coca-Cola bottles"). Some early data on reservoir siltation at Gibraltar Dam was used by Dalen et al. (1973) who used a double-mass balance to show fire effects on erosion from 1922 to 1969. This study, while showing the effects of dams, provides little help with the present coastal sediment delivery problem.

Since 1966, sediment measurements have been made on selected streams in this region, but most were discontinued in 1978. One of the most comprehensive studies has been on the Santa Clara River, (Williams 1979) and sampling is continuing on this river. Kroll (1975) has reported measurements made on the Santa Maria River.

B.2 Fire History of the South Central Region

The history of fires in the South Central Region goes back to 1910, although a study by Byrne (1979) provides fire statistics from 735 to 1520. Using measured charcoal concentrations in the sediments of deep submarine canyons of

the Santa Barbara Channel, Byrne found that a major fire occurred every 65 years on the average, and that inland fires occurred every 30 to 35 years. The study indicated that the fires were of a conflagration type, and Byrne hypothesized that the 30 year cycle was related to the 30 year drought cycle found in tree-ring data. However, it may be related to the life pattern of chaparral, which becomes extremely susceptible to fire after 30 years.

The most extensive fire history in the region is kept at the Los Padres National Forest, and fire maps from this agency are being provided under a separate cover. Table 4.8 lists the major fires since 1910 in this region. Note that there have been no major fires within the portion of the Los Padres National Forest included in the South Central Region since 1972.

It should be noted that there were a large number of major fires between 1917 and 1932, including the Matilija Fire, which is the largest recorded in California. There were relatively few between 1935 and 1953, but the frequency seems to increase again between 1955 and 1967, consistent with a 30 to 35 year cycle. One would expect fewer major fires in more recent years as fire suppression techniques have become more sophisticated.

One should also note the number of fires occurring on or about the same date, which usually indicates Santa Ana wind conditions. It is obvious that weather is a major factor in producing large fires, despite the high frequency of fires deliberately set.

C. Data Search and Retrieval Efforts

C.1 Technical Approach

Data were collected from a number of governmental and public organizations. Previous reports and documents on similar topics were located and examined as part of the literature search. These documents often contained or referred to data, whose original sources were noted. An important source during the initial stages were the notes and documents collected by Brent Taylor during the Sediment Management project at the Environmental Quality Laboratory (EQL), Caltech. Government and public agencies were then contacted, and in many cases visited. The following is a general description of data sources relevant to the South Coast Region.

San Luis Obispo County Flood Control and Water Conservation District

Relevant data include:

Precipitation data, with hourly (hard copy) and summaries (daily, intensities) etc. on hard copy and computer. Charts of recording gages also maintained.
Streamflow: daily averages on hardcopy and computer (recent only). Hydrographs at selected stations maintained.
No debris, sediment or fire records are maintained.

People contacted include:
Ann Hall (precipitation, streamflow)
(805) 549-5273
Glenn Britten (precipitation, streamflow)
(805) 549-5268

Santa Barbara County Flood Control and Water Conservation District

Relevant data include:

Precipitation data, in hard copy form; charts available from recording gages.
Limited data on debris basin cleanouts, sedimentation in the Goleta Slough.
Streamflow data are limited; U.S.G.S. now maintains all stations in the County.

People contacted include:
John Fertig (debris, sedimentation) (805) 963-7125
Wayne Smith (precipitation)
Phil Holland (precipitation)
James Stubchaer (manager)

Ventura County Flood Control and Water Resources Department

Data include:

Precipitation--hard copy and on computer data base.
Streamflow--hydrographs and daily measurements, hard copy and on computer data base.
Debris basin cleanout data.
Beach profiles made monthly.
People contacted include:
Dolores Taylor (streamflow, precipitation)
(805) 654-2014
Fran Solis (beach profiles) (805) 654-2906
Bill Dorè (computer data) (805) 654-2908

Los Angeles County Flood Control Agency.

The data available at this agency include:

Precipitation data, with both hourly and the original charts or punch tape from recording gages;
Streamflow data, with both daily and charts or punch tape from recording gages;
Debris data, including hand entered tables of the quantities of debris stored and removed from debris basins;
Fire history, including topographic maps with outlines and dates of fires from about 1910 and fire reports on recent fires (older fire reports are archived).
Streamflow and precipitation data are on microfilm up to 1977. The most recent publication covers the 1975-77 period.
People contacted include:
John Mitchell, Head, Operations Section (213) 226-4190
Don Carpenter (rainfall), Hadi Nourzi (fires, debris)
(213) 726-4184
Tom Alexander (fires, debris), Ed Dingman (streamflow).
Eric Bredehorst (frequency analysis) (213) 226-4089
Bob Sarasua (streamflow records) (213) 226-4179

U.S. Geological Survey

Data available from this agency include:

Streamflow, with daily and monthly flows, peak flows and storm hydrographs available.
Sediment, with data available in published reports. Unpublished data are also available at the Laguna Niguel and Santa Barbara offices.
Data are in reports (Water-Supply Papers and, more recently, Water Resources Data) and in electronic form at the Sacramento District Office, where a data base is maintained.
People contacted include:
Dave Sheets (Santa Barbara Office) (805) 962-8114
Bill Brown (Menlo Park Office) (415) 856-7112
Chris McConaughy (Laguna Niguel Office) (714) 643-4232
John Beck (Sacramento Office, Water Resources Data)
(916) 484-4830

U.S. Forest Service

Data available from this agency include:

Fire history with fire maps available for fires in the National Forests; Sedimentation and Erosion data from the San Dimas Experimental Forest. These data includepre- and post-fire runoff measurements from both natural and controlled burns, water repellency data, vegetation and soils information. For information in this area, contact the Pacific Southwest Forest and Range Experiment Station, Riverside.

People contacted include:
Wade Wells (714) 351-6515, PSWF&R
Charles Colver (818) 684-0350, San Dimas Experimental Forest
Carol Keniflit (714) 351-6555, PSWF&R
Bob Blecker, Los Padres National Forest, Goleta, CA
(805) 683-6711

California Department of Water Resources

Data from this agency include:

Streamflow, with data available in the Water Data Information System (WDIS). Data are available on microfiche (least expensive) and electronic form.
Precipitation, also available on WDIS.
Wind data are available in limited form, as it is gathered only in conjunction with particular contracts.

People contacted include:
Bill Mork, State Climatologist (916) 445-5800

Environmental Quality Laboratory, California Institute of Technology

Data from the sediment management project are archived. Data readily available include maps of vegetation cover, debris basins, and fire history.

People contacted include:
Dr. Robert C. Y. Koh (Keck Laboratory) (818) 356-4400
Prof. Norman H. Brooks (presently on sabbatical leave)
Theresa Fall (EQL) (818) 356-6420

There are several reference libraries in the South Coast Region which are extremely helpful. These include:

University of California, Water Resources Archives, Beth Willard, Librarian (213) 825-7734

This reference library has an extensive collection of publications, manuscripts and material relevant to this study. There is a large

collection of uncataloged documents from local agencies as well. In addition, material not available at the UCLA Water Resources Archives can usually be obtained from Berkeley through UCLA. Sources are well cataloged and easy to find.

California Department of Water Resources, Southern Division, Los Angeles

The records and documents section combine an extensive collection of California State publications. In addition, there is a large collection of relevant documents and publications from local and federal agencies, including the County Flood Control Agencies. Sources are well cataloged and easy to find.

California Institute of Technology Libraries

Extensive collection of relevant journals and some federal and state publications. The best sources are the Environmental Engineering Library, Keck Laboratory, and the Engineering Library (Millikin Libraries). Unfortunately, the collections are spread out over several buildings and a certain amount of searching is often required.

University of California, Los Angeles Engineering Library and Geology Library

These two libraries have extensive collections of relevant journals. The Engineering Library has vast holdings of Weather Bureau/Weather Service publications. The geology library has all relevant U.S. Geological Survey Water-Supply Papers (as do the Water Resources Archives, where they cannot be checked out) and other U.S.G.S. publications. Both are excellent sources for reference material.

U.S. Army Corps of Engineers, Los Angeles District Library

This library has most Corps of Engineers publications, including Beach Erosion Board and CERC publications. Some publications from local and state agencies are also available, as are some U.S.G.S. Water-Supply Papers. References are often miscataloged and difficult to find.

C.2 Hydrologic Data Available

Tables 4.9 and 4.10 can be used quick references for stream gages of interest in this area. More detailed information is included in Appendix C.

C.2.1 Morro Bay Group

All stream gages in this region are operated by the San Luis Obispo County Flood Control and Water Conversation District. Recent daily flow data are kept on computer files and are easily accessible;all records are available in tabular form. Note that most data records begin after 1970, with the exception of Arroyo de la Cruz, which begins in 1950.

Charts from the stream gages are archived and storm hydrographs can be obtained by specifying the stream and date of record.

C.2.2 Arroyo Grande Creek

Arroyo Grande Creek, now controlled by Lake Lopez, has been gauged since 1939. Daily streamflow data are available from U.S.G.S. publications, and from the U.S.G.S. office in Sacramento (John Beck) where all daily measurements are kept on a computer data base. Charts from the recording gages are kept and can be obtained from the U.S.G.S. for developing storm hydrographs.

Sediment measurements have been made on the Arroyo Grande, but only upstream of Lake Lopez; some of these data have been analyzed (Knott, 1976). These data are helpful in determining the effect of Lake Lopez on sediment yield, but are of little help in determining sediment delivery to the coast. These data are also available at the U.S.G.S. Sacramento office.

C.2.3 Santa Maria River, San Antonio Creek and Santa Ynez River.

These three streams drain more than 80% of the South Central Region north of Point Arguello. Continuous streamflow records are available at the U.S.G.S. from 1940 for the Santa Maria and Santa Ynez Rivers, and from 1955 for the San Antonio Creek. In addition, records for the Santa Ynez River at Lompoc are available from 1906 with some gaps in the data (1907, 1919-1926), but this station (11-1335.00) records only 77% of the uncontrolled drainage area, and 88% of the total drainage area. Upstream records are also available for San Antonio Creek from 1940 to 1955. Daily flows are in U.S.G.S. publications and available from the Sacramento office (John Beck). Data from the recording gages are available at Laguna Niguel (Chris McConaughy) where storm hydrographs can be obtained.

Daily sediment measurements were made on the Santa Maria River at Guadalupe from 1968 until 1971. These data are also available at Laguna Niguel, including some sediment size distributions. Both raw data records and some analyzed results are available, and can be obtained by specifying the period of record needed.

The Gibraltar Reservoir was selected as a "barometer" watershed in 1967, as part of a U.S.F.S. program to evaluate forest management in the south coast area. Sedimentation and other hydrologic data are available, and have been analyzed (Dalen, Erwin and Blecker, 1973). These are important data on the effects of dams and forest fires on sediment yield. More information can be obtained through Bob Blecker, U.S.F.S., Los Padres National Forest.

C.2.4 Santa Ynez Mountains Group

Most of the more than fifty small streams which discharge to the ocean in this group are not gauged. The major ones which have been gauged are listed in Table 4.10, and the others are in Appendix C. These gages are all operated by the U.S.G.S. and daily records are available in U.S.G.S. publications, and at the Sacramento office (John Beck). Recent charts (last four years) from the gages are available at the U.S.G.S. office in Santa Barbara (Dave Sheets); others are archived at Laguna Niguel (Chris McConaughy).

Daily sediment measurements were made in Atascadero, San Jose and Tecolito Creeks, which drain to the Goleta Slough, during five months in the 1981-82 water year. The results of these measurements have been published in the 1982 Water Resources Data for California; the original data are available at Laguna Niguel (Chris McConaughy).

There are a number of debris basins in this region. Measurements have not been made of cleanouts, but estimates have been made by Jack Fertig (Santa Barbara County Flood Control and Water Conservation District) for this study. These data are being submitted under a separate cover. Additional records can be obtained from Jack Fertig.

C.2.5 Ventura and Santa Clara Rivers, and Calleguas Creek

The Ventura River has been gauged by the U.S.G.S. from 1911 until 1914. The Santa Clara River has been gauged from October 1927 to September 1932, and from 1949 to the present. However, monthly discharge only is available from 1950 to 1967. Estimates of flow to the ocean for the period 1932 to 1967 could be made by combining the data from Sespe Reach, Santa Paula Creek, Piru Creek and the Santa Clara River at Los Angeles-Ventura County Line or near Piru, but a large portion of the basin is not included in the drainage areas of these gages. Calleguas Creek has been gauged by the U.S.G.S. since 1955. Data from the U.S.G.S. are available in publications and from the computer data base in Sacramento (John Beck). Chart recordings of the stream gages from which hydrographs can be developed are archived at Laguna Niguel (Chris McConaughy).

Twenty-six debris basins exist in these drainage areas, and are maintained by the Ventura County Flood Control and Water Resources Department. Detailed records of cleanouts are kept, examples of which are included in the Appendix C along with location maps. More information is available from Mike Taylor or Dolores Taylor, Ventura County Flood Control and Water Resources Department.

Extensive measurements of sediment discharge have been made on the Ventura and Santa Clara Rivers since 1967. Measurements were made at Calleguas Creek from 1968 to 1978; measurements were also made at upstream locations in these basins from 1968 to 1978. These data are available in the U.S.G.S. computer data file in Sacramento, and at Laguna Niguel. The data include concentration and size distributions from selected samples. Some analyses of these data have been

done in connection with particular projects (Brownlie, 1981; Williams, 1979; Scott and Williams, 1973; Kroll, 1975). In addition, some data have been used in particular studies carried out by the Ventura County Flood Control and Water Resources Department (Dolores Taylor); included is a long-term study started in July 1975 on sediment supply to the ocean from the Santa Clara River.

C.2.6 Forest fires and their effects

The best data source for this subject is the U.S. Forest Service, Los Padres National Forest (Bob Blecker). Detailed fire history maps starting in 1910 are kept (copies of these are being submitted under a separate cover); fire data are also kept on computer data files (data listings are provided under a separate cover). Detailed frequency-area analyses have been made (Fritz Cahill) and are available. (Some of the main features of their work are presented in Appendix C). Data are kept on fires both within and outside the National Forest. Extensive fire suppression programs are underway (prescribed burns in particular) and data are maintained and analyzed to determine the efficacy of these programs. This is an important source of data.

Other sources include the Los Angeles County Department of Public Works, Hydraulic Division (formerly Los Angeles County Flood Control District) which keeps detailed fire maps and fire reports on fires in the portion of the Santa Clara River basin which lies in Los Angeles County. Fire maps from the Caltech Sediment Management Study, compiled by Wade Wells (U.S.F.S., Riverside) are being submitted under a separate cover. Wade Wells can be contacted for questions or details on the preparation of these maps.

C.2.7 Frequency Analyses

Most studies to date have dealt with flood frequency analysis, and use the annual peak flow. Data are available (on punch cards) at the Ventura County Flood Control and Water Resources Department (Dolores Taylor) for volume analysis, but the analyses have not been performed. Peak flow analyses have been performed for stream gages, and are available (Dolores Taylor). These analyses are somewhat different from the more sophisticated Corps of Engineers method (Dolores Taylor, 1985, personal communication) but are updated regularly, and can be made rapidly upon request. Peak-flow frequency analyses have been conducted by the U.S. Geological Survey (Waananen and Crippen, 1977; Young and Cruff, 1967) and are available in the U.S.G.S. publications.

C.2.8 Other related sources of data

An analysis of effects of debris basins and mines for the southern portion of this region was conducted by Kolker (1982). Statistics on mining are available from the U.S. Bureau of Mines Mineral Yearbook; other data are available in Evans et al. (1977).

Although the original hydrographs or the original stream data are best for analyses, recent storm hydrographs for major floods are available in several publications (Waananen, 1969; Wahl et al., 1980; Ventura County, 1969).

D. Data Gaps and Limitations

The most serious shortcoming of the data available in the South Central Region is the lack of sediment measurements on the Santa Maria and Santa Ynez Rivers, and the Morro Bay and Santa Ynez Mountains Groups. Only the Santa Maria River has a short record of sediment measurements (Kroll, 1975). These streams and stream groups are extremely important in sediment supply to this region and data are needed especially for the major rivers. Some estimates could be made on the sediment supply to the ocean from the Santa Ynez River, based on reservoir deposition, for example, in the Gibraltar watershed (Dalen et al, 1973), but the character of the watershed terrain changes after Cachuma Lake, and only rough estimates could be made. The same is true for the Santa Maria watershed, now controlled by Twitchell Reservoir.

A second problem area is that of volume-frequency analysis. There is a need for updated frequency analyses for all gauged streams in this region, especially volume-frequency. The data exist which could be used to make these analyses, and are in an extremely accessible form (U.S.G.S. data files, Sacramento, John Beck) and could be rapidly done. The major streams have forty or more years of data (at the ocean outlets), and reasonably accurate results can be obtained.

Hydrographs, when needed for both minor and major storm events, are archived (U.S.G.S., Laguna Niguel) and are available. For the smaller streams, especially those in the Morro Bay and Santa Ynez Mountains Groups, records are recent, but still cover very dry and very wet periods, so that the extremes are available. One limitation is that the older records and many new ones are on charts, and are not digitized, which prevents convenient access.

Fire history, fire frequencies and effects of fires on sediment yield are well documented in this region, and the Los Padres National Forest (Bob Blecker, Fritz Cahill) is an excellent source of data.

Some work has been done on sedimentation in reservoirs in this region (Dalen et al., 1973), but there is little on the direct effect of debris basins, dams and mining on sediment yield. Data exist on quantities of sediment trapped or mined, but these indicate only losses to a virtually unknown supply (due to lack of sediment measurements).

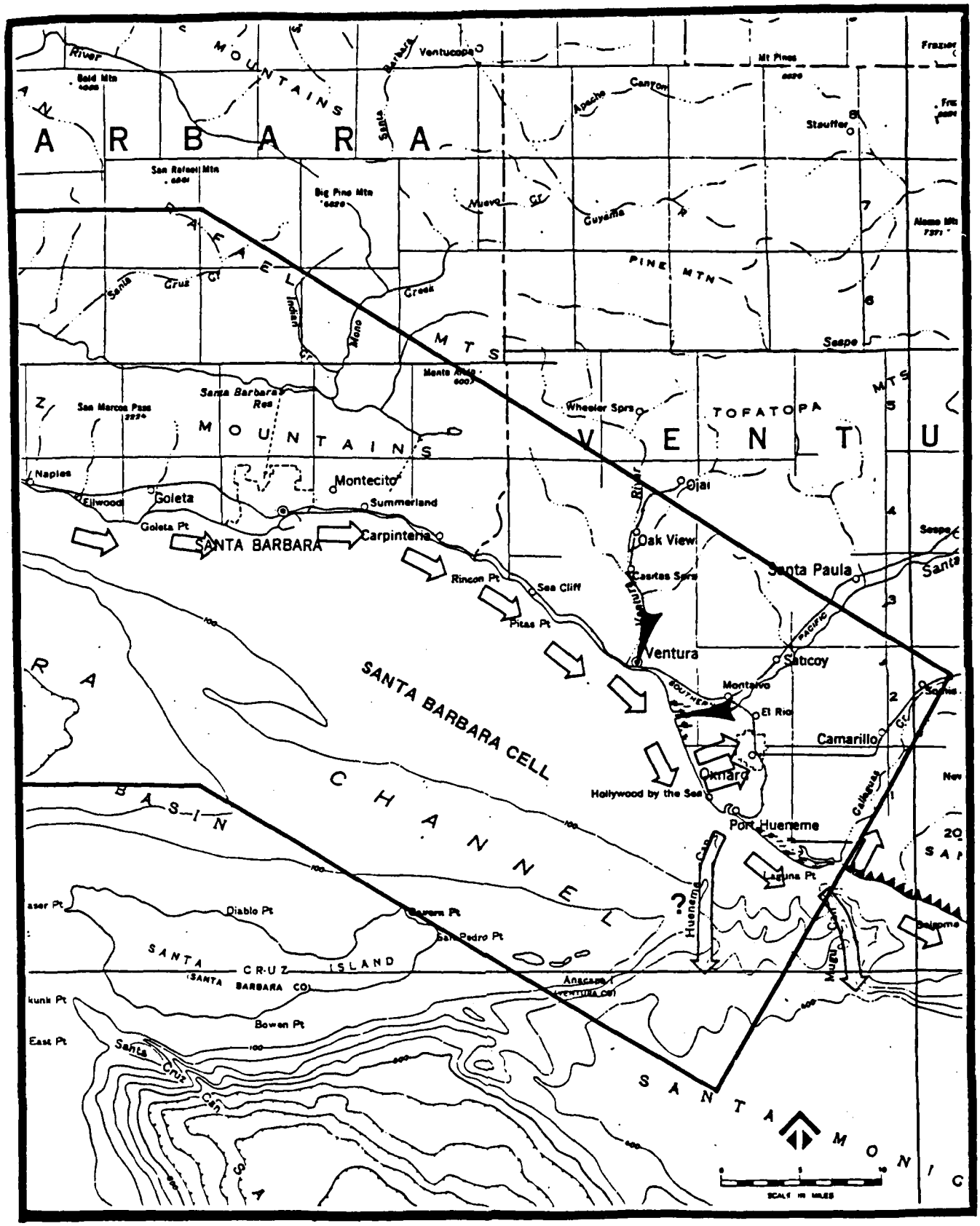

Figure 4.1 South Central Region

Source: Calif. DNOD Atlas of Shoreline Erosion

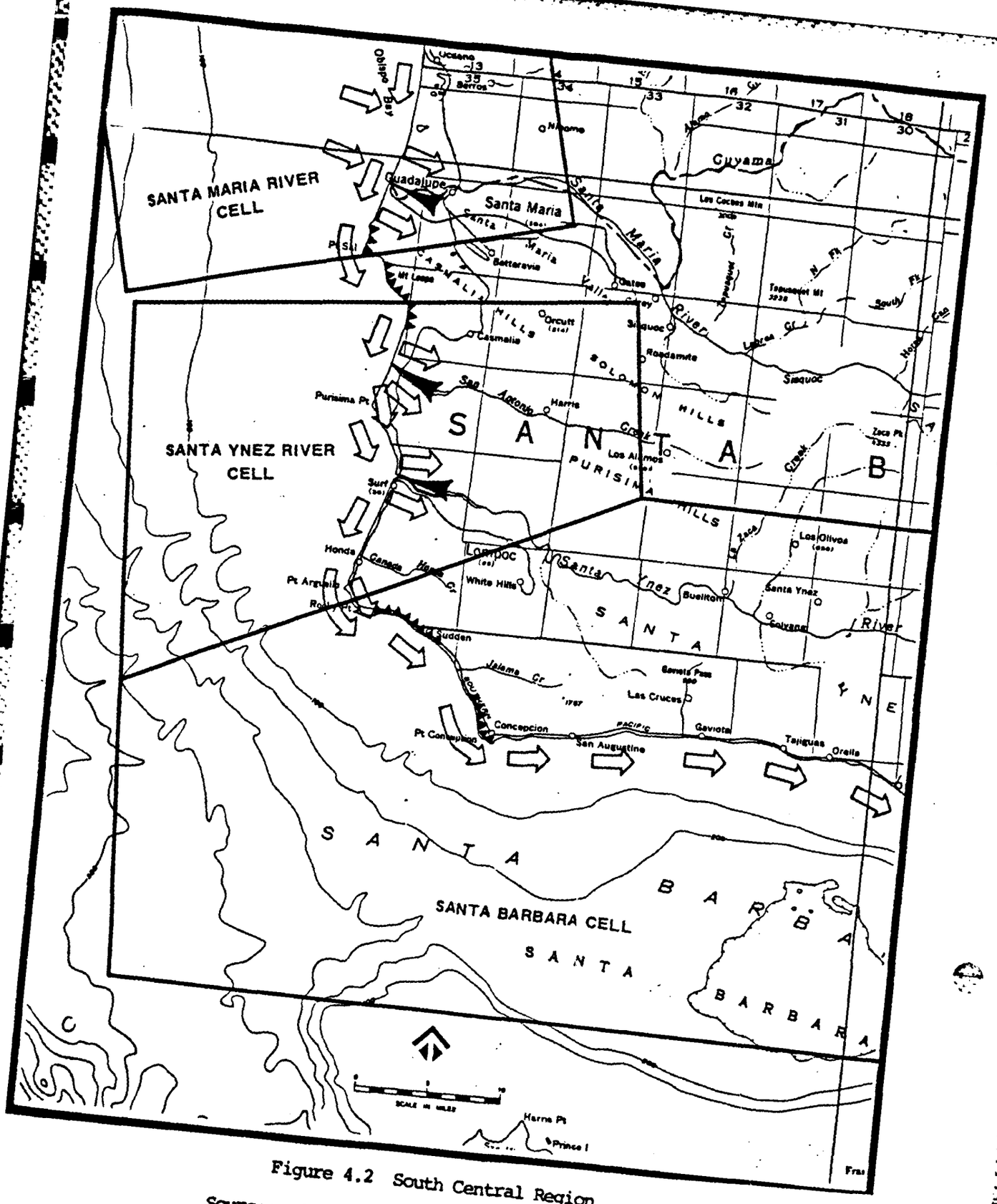

Figure 4.2 South Central Region

Source: Calif. DNOD Atlas of Shoreline Erosion

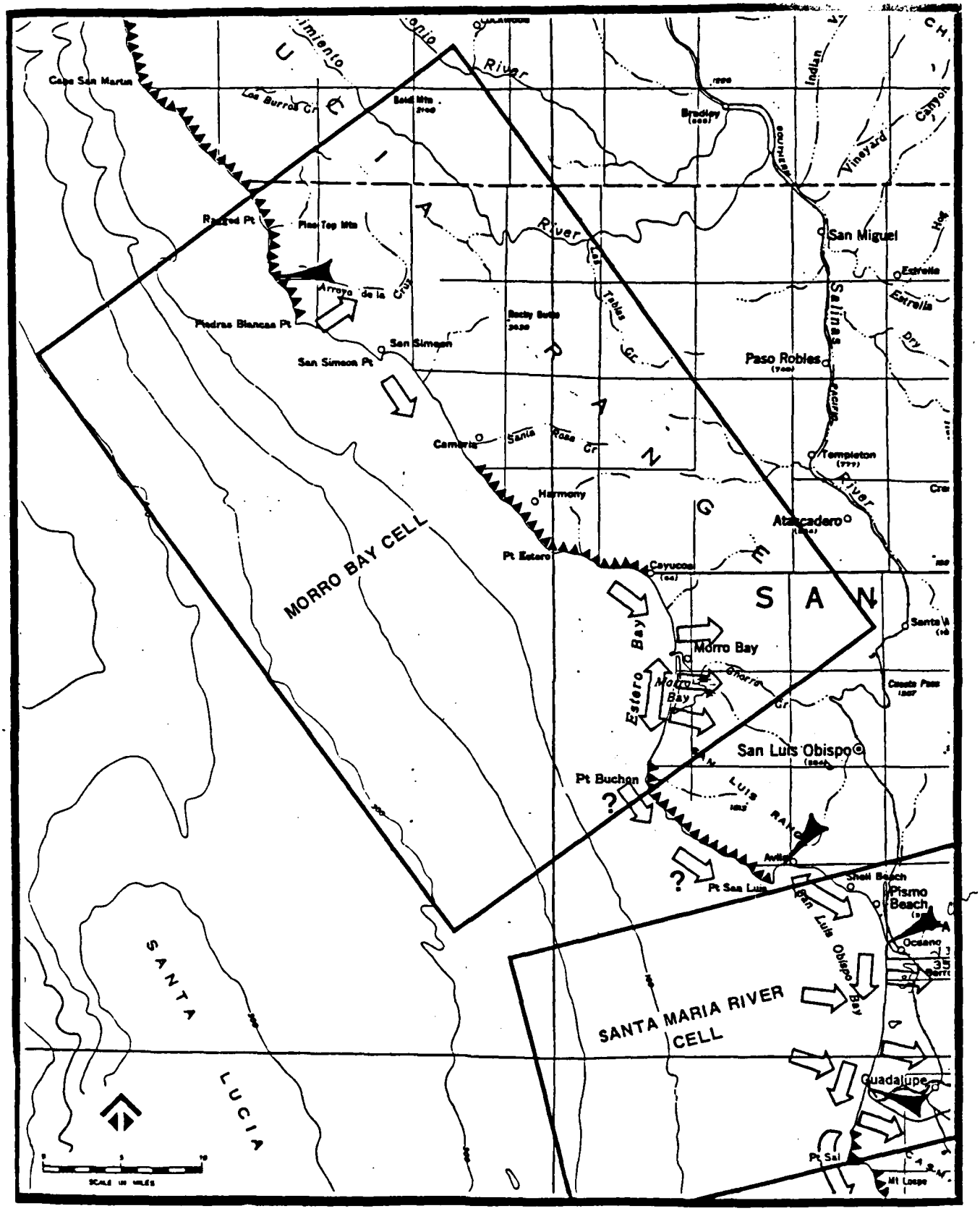

Figure 4.3 South Central Region

Source: Calif. DNOD Atlas of Shoreline Erosion

TABLE 4.1

Major Drainage Areas of the South Central Region

Basin or Group	Littoral Cell	Drainage Area Mi2	Controlled Area Mi2	Percent Controlled
Morro Bay Group	Morro Bay S Morro Reach	575	20	3
Arroyo Grande Creek	Santa Maria	190	70	37
Santa Maria River	Santa Maria	1873	1120	60
San Antonio Creek	Santa Ynez	206	-	-
Santa Ynez River	Santa Barbara	901	421	47
Santa Ynez Mtns Grp	Santa Barbara	420	2	-
Ventura River	Santa Barbara	275	94	34
Santa Clara River	Santa Barbara	1690	590	35
Calleguas Creek	Santa Barbara	323	-	-
Total		6453	2317	36

Source: Brownlie and Taylor (1981)

TABLE 4.2

River Features, South Coast Region

River or Stream	Length (approx) Mi	Maximum elevation	Slope Range	Other Features
Arroyo Grande	12 *	3100	.008*	Upper reach controlled
Santa Maria River	130 **	8800	0.002-0.02	Cuyama watershed controlled
Santa Ynez River	81	6600	0.002 - 0.04	Upper half controlled
Ventura River	30	5000	0.01 - 0.05	
Santa Clara River	68	8830	.006	Upper watersheds controlled
Calleguas	30	2100	.006	Terminates in Mugu Lagoon

* below Lopez Dam

** includes Cuyama River length

TABLE 4.3

Precipitation at Selected Stations, South Central Region

Location, DWR no.	Elevation Feet	Precipitation (in.) Average	Maximum	Minimum	Years of Record	Latitude, Longitude
Hearst Castle, 3888-02	1800	31.4	61.5	10.4	33	35-41-12 121-10-12
San Simeon 7885-11	16	19.1	33.5	11.9	39	35-38-24 121-11-36
Morro Bay 5866-00	115	15.6	29.6	7.1	22	35-22-00 12-51-00
San Luis Obispo 7851-00	298	21.6	54.6	7.3	111	35-18-20 120-39-47
Santa Maria 7940-00	223	13.6	30.7	6.1	76	34-57-00 120-26-00
Ozena 6576-00	3704	13.0	27.1	4.6	51	34-42-33 119-19-00
Juncal Dam 4422-00	2060	27.6	64.2	10.4	36	34-29-00 119-31-00
Santa Barbara 7902-00	16	15.4	36.9	6.9	37	34-25-00 119-42-00
Ventura 9285-00	46	15.2	36.7	5.2	106	34-16-36 119-17-30
Ojai 6399-00	784	21.4	48.0	6.8	72	34-26-48 119-14-31
Oxnard 6569-00	49	14.3	38.2	5.5	51	34-12-05 119-10-30
Gorman 3511-11	3680	12.0	31.2	4.8	38	34-47-16 118-49-55
Elizabeth Lk 2734-25	2073	21.9	43.5	10.2	49	39-40-00 118-21-45
Bouquet Res 1013-00	3054	16.1	33.0	6.9	46	34-35-14 118-21-45
Thousand Oaks 8905-00	800	14.5	31.9	5.5	17	34-10-43 118-51-00

Source: Calif DWR Bull 230-81

TABLE 4.4

Mean Monthly Precipitation* at selected stations, South Central Region

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
San Luis Obispo	4.6	4.0	3.2	2.3	0.3	.05	.04	.01	.15	0.7	2.6	4.0
Santa Maria	2.3	2.4	2.0	1.3	0.2	.04	.03	.02	0.1	0.5	1.4	2.1
Ozena	2.4	2.5	2.0	1.0	0.3	.05	.06	0.1	0.2	0.5	0.8	2.3
Juncal Dam	6.7	5.7	3.8	2.7	0.3	.06	.01	0.	0.2	0.5	3.8	4.4
Pt. Arguello	2.6	2.5	2.3	1.5	0.2	.04	.03	.01	.06	0.7	1.6	2.3
Santa Barbara	3.5	3.0	2.4	1.5	0.2	.03	.04	.01	.07	0.4	1.9	2.5
Ventura	2.8	2.6	2.3	1.3	0.1	.04	.01	0.	.04	0.3	1.9	2.2
Ojai	4.6	4.2	3.0	2.1	0.3	.04	.02	.01	0.2	0.4	2.7	3.2
Oxnard	3.1	2.8	2.2	1.4	0.1	.04	.01	.01	.06	0.3	1.9	2.5

*1941-1970

Source: Calif DWR California Rainfall Summary, 1981
Goodridge (1981)

TABLE 4.5

Major Control Structures, South Central Region

Name	Watershed	Drainage	Year Completed	Remarks
Whale Rock Res	Old Creek (Morro Bay Grp)	20.8	1960	
Lake Lopez	Arroyo Grande	70	1969	
Twitchell Res	Cuyamaca R (Santa Maria R)	1135	1958	
Cachuma Lake	Santa Ynez R	421	1953	Bradbury Dam
Gibraltar Dam	Santa Ynez R	(214)	1920	Upstream of Cachuma
Jameson	Santa Ynez R	(13.9)	1930	Upstream of Gibraltar Juncal Dam
Matilija	Matilija Cr (Ventura R)	55	1949	
Casitas	Coyote Cr (Ventura R)	39	1959	
Lake Piru	Piru Cr (Santa Clara R)	421	1955	Santa Felicia Dam
Pyramid	Piru Cr (Santa Clara R)	293	1973	Upstream of L Piru
Bouquet Res	Bouquet Cr (Santa Clara R)	13.6	1934	
Castaic Lake	Castaic Cr (Santa Clara R)	154	1973	
Dry Canyon Res	Dry Canyon (Santa Clara R)	4.5	1912	

Source: Calif DWR Bulletin 17-84

TABLE 4.6

Streamflow and Sediment Delivery, South Central Region

River/Stream	Ave. Flow cfs.	Max. Flow cfs - Year	Sediment		Remarks
			Ave. 1000 tons/yr	Max. - day 1000 tons/day	
Arroyo Grande	19.4 (14)	5400 - 1966 (2990) - (1969)	N.A.	N.A.	( ) = since 1968
Santa Maria R	28.2	32800 - 1952	N.A.	2,030 - 1969	
San Antonio Cr	5.5	3440 - 1978	N.A.	N.A.	
Santa Ynez R	50	120000e - 1907 (80000) - (1969)	N.A.	N.A.	e = estimate ( ) = since 1952
Jalama Cr	3.7	4020 - 1978	N.A.	N.A.	
Gaviotal Cr	5.9	4000 - 1967	N.A.	N.A.	
San Jose Cr	2.8	2330 - 1978	5.7	0.48	1981-82 only
Atascadero Cr	4.7	5380 - 1973	2.8	0.18	1981-82 only
Mission Cr	3.2	2580 - 1973	N.A.	N.A.	
Carpenteria Cr	2.9	8800 - 1971	N.A.	N.A.	
Ventura R	58	63600 - 1969	480 eq	20,400 - 1969	eq = estimate of EQL
Santa Clara R	142	165000 - 1969	3670 eq	20,400 - 1969	
Calleguas Cr	35.5	25300 - 1980	286 eq	1,700 - 1969	

Source: U.S.G.S Water-Supply Papers
U.S.G.S Water Resources Data
Brownlie and Taylor (1981)

N.A. = Not available

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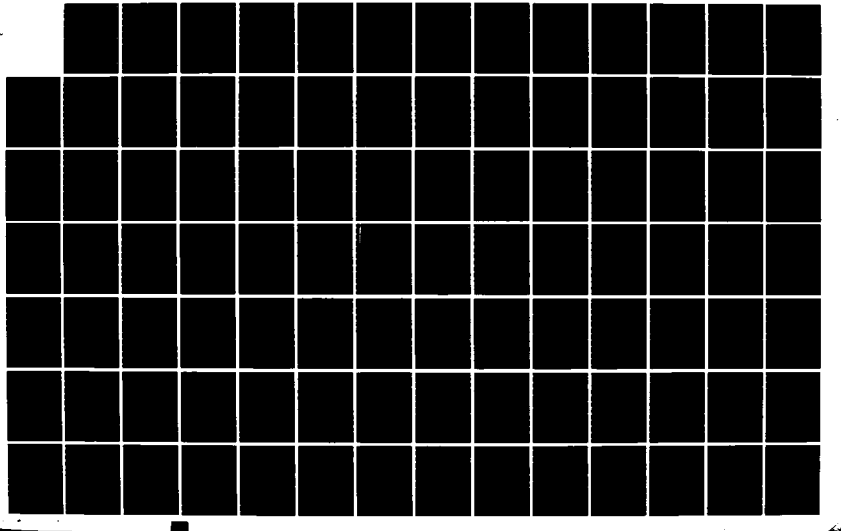

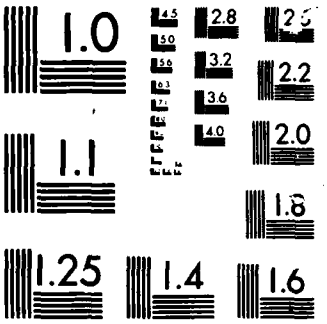

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TABLE 4.7

Peak Flows (CFS) During Major Floods, South Central Region

Stream	1914	1938	1941	1952	1969	1978	1980	*
Arroyo Grande	N.A.	N.A.	3100	5370	3800	1980	1070	5400 - 1966
Santa Maria R	N.A.	38000	14700	32800	27200	22200	9700	100000 - 1909
Santa Ynez R	75000	45000	20200	39000	80000	63200	15600	120000 - 1907
Ventura R	N.A.	39200	15200	29500	58000	63600	39000	35000 - 1943
Santa Clara R	N.A.	120000	N.A.	N.A.	165000	102200	81400	
Calleguas Cr	N.A.	N.A.	N.A.	N.A.	16310	25300	18700	

*Other local flood flows with year.
N.A. = not available
Note: For stream gage location, see Tables 4.9 and 4.10

Sources: U.S.G.S. Water-Supply Papers
U.S.G.S. Water Resources Data for California

TABLE 4.8

Major Forest Fires, South Central Region, 1910-1975

Year	M/Day	Location/Name	Watershed	Area Burned Acres
1912	10/14	Branch Mtn	Cayama R	12000
1913	9/27	Huasna Cr	Arroyo Grande Cr	13500
1917	6/15	Carpenteria	Santa Ynez Gp	20000
1917	6/15	Matilija	Ventura R	28320
1917	9/28	Sespe Cr	Santa Clara R	46700
1919	10/	Pacoima Cyn	Santa Clara R	72500**
1922	8/4	Cuesta	Arroyo Grande Cr	11860
1922	9/	Mint Cyn	Santa Clara R	15900
1922	9/11	Sycamore	Cuyama R	26560
1922	9/14	Kelly Cyn	Sisquoc R., Cuyama R	59600
1923	8/2	Sweetwater	Sisquoc R	27000
1923	9/1	Oso	Santa Ynez R	70000
1927	8/7	Rinconada	Arroyo Grande Cr	13640
1928	9/1	Piru Cr	Santa Clara R	39400
1928	9/1	Aliso Cyn	Cuyama R, Sisquoc R	42800
1929	9/15	Sully	Cuyama R	21000
1929	10/	San Antonio Cr	Ventura R	26800
1931	8/25	Toro Cr	Morro Bay Grp	13000
1932	9/7	Matilija	Ventura R, Santa Clara R	219254 (a)
1933	8/19	Indian Cyn	Santa Ynez R	30800
1944	8/26	San Marcos	Santa Ynez R	12080

(continued on next page)

TABLE 4.8

Major Forest Fires, South Central Region, 1910-1975
(cont.)

Year	M/Day	Location/Name	Watershed	Area Burned Acres
1948	9/12	Wheeler Sp	Ventura R, Santa Clara R	25885
1949	10/31	Thousand Oaks	Calleguas Cr	19100
1950	7/3	Pine Ridge	Cuyama R	15100
1953	7/10	Big Dalton	Cuyama R, Sisquoc R	73450
1955	9/6	Refugio	Santa Ynez Grp, Santa Ynez R	84770
1955	11/7	Sycamore Cyn	Santa Monica Mtns	13100**
1956	11/29	Arroyo Sequit	Santa Monica Mtns	16200**
1960		Magic Mountain	Santa Clara R	28600
1964		Dry Canyon	Santa Clara R	13500
1964	9/22	Coyote	Santa Ynez R, Santa Ynez Mtns	67000
1967	10/15	Thousand Oaks	Callequas Cr	26900**
1967	10/15	Santa Paula C	Santa Clara R	20400
1967	10/16	Timber Cyn	Santa Clara R	11400
1970	9/25	Santa Susana Mtns	Santa Clara R	115472**
1970		Mint Cyn	Santa Clara R	24700
1971	10/6	Romers	Santa Ynez Mtns	14538
1972	8/22	Bear	Sespe Cr	17150

**Includes area burned in South Coast Region.

(a) Largest recorded fire in California.

Sources: Caltech EQL Fire Maps,
Wells (1982)
Los Padres National Forest Fire Maps

TABLE 4.9

STREAM GAGING, NORTH OF POINT ARGUELLO, SOUTH CENTRAL REGION

STREAM	AGENCY	PERIOD OF RECORD	TYPE	USGS #	OTHER #	REMARKS
Arroyo de la Cruz	SLOC	Oct. 1950-	R	11-1425.00	AC	
Chorro Creek	SLOC	Nov. 1978-	R	---	CR	Near Morro Bay
Los Osos Creek	SLOC	Feb. 1976-	R	---	LO	Near Los Osos
Morro Creek	SLOC	Oct. 1970-	R	11-1420-80	MO	
San Bernardo Creek	SLOC	Oct. 1959-Oct. 1965 Sep. 1976	R	11-1420.60	SB	
San Luis Obispo Cr.	SLOC	Oct. 1970-	R	---	LL	Near Avila
San Simeon Creek	SLOC	Sep. 1970-	R	---	SS	Near Cambria
Santa Rosa Creek	SLOC	Dec. 1975-	R	11-1422.50	LR	At Cambria
Toro Creek	SLOC	Oct. 1970-	R	11-1421.00	To	
Villa Creek	SLOC	Sep. 1970-	R	---	VI	Near Harmon
Arroyo Grande	USGS	Oct. 1939-	R,S	11-1450.00	--	Controlled by Lopez Lake after 1968
Santa Maria River	USGS	Oct. 1940-	R,S	11-1410.00	--	At Guadalupe-daily sediment 1968-71
Santa Ynez River	USGS	1947-1965	R	11-1355.00	--	Barrier Reef
		1941-	R	11-1350.00	--	Lompoc
		1954-1975	R	11-1345.00	--	Lompoc 13th St.
		1906-1960	F,R	11-1335.00	--	Lompoc
San Antonio Creek	USGS	1955-	R	11-1361.00	--	Near Casmalia
Jalama Creek	USGS	1965-1982	R	11-1206.00	--	

Note: for Latitude, longitude and drainage area of these and other gages, see Appendix C.

SLOC = San Luis Obispo County Flood Control and Water Conservation District

USGS = U.S. Geological Survey

F = Daily Flow

S = Sediment

R = Recording gage

TABLE 4.10

STREAM GAGING SOUTH OF POINT ARGUELLO, SOUTH CENTRAL REGION

STREAM	AGENCY	PERIOD OF RECORD	TYPE	USGS #	OTHER #	REMARKS
Gaviota Creek	USGS	Oct. 1966-	R	11-1205.50	---	
San Jose Creek	USGS	Jan. 1941-	R,S	11-1205.00	---	5.5 $mi.^2$ drainage area
		Oct. 1970-	R,S	11-1205.10	---	9.4 $mi.^2$ drainage area
Atascadero Creek	USGS	Oct. 1941-	R	11-1200.00	---	
Maria Ygnacio Creek	USGS	Oct. 1970-	R	11-1199.40	---	
Arroyo Burro Creek	USGS	Oct. 1970-	R	11-1197.80	---	
Mission Creek	USGS	Oct. 1970-	R	11-1197.50	---	
Carpenteria Creek	USGS	Jan. 1941-	F	11-1195.00	---	1977-78 missing
Ventura River	USGS	Sep. 1911-Jan 1914	F,S	11-11850.00	608(VC)	Near Ventura,
		Oct. 1929-	R,S			Sediment Oct. 69
Santa Clara River	USGS	Oct. 1927-Sep. 1932	F,S	11-1140.00	708(VC)	Sediment Oct. 67
		Oct. 1949				
Calleguas Creek	USGS	Oct. 1968-	F,S	11-1065.00	806(VC)	Near Camarillo
						Sediment Oct. 68-78

See notes, Table 4.9

VC = Ventura County

5.0 Special Problems and Techniques

This section is provided to give guidance on special problems in the analysis of hydrologic data.

A. Double-Mass Analysis

Double-mass analysis is used to check the consistency of many kinds of hydrologic data by comparing two related series of quantities. In general, one plots the cumulative values of one series against those of another. An example is the plotting of cumulative runoff over a period of time versus the accumulated sediment in a reservoir over the same period. This representation allows a quick determination in changes in the sedimentation pattern, as might be caused by a forest fire. Sudden breaks in the slope of the resulting curve often indicate significant events which occurred, such as forest fires, major intense storms, landslides, etc.

This technique is not limited to sediment data, and can be applied to a variety of variables, such as cumulative rainfall versus cumulative river discharge, to determine the effects of urbanization or control structures. The only difficulty lies in the interpretation of the results, as several factors may cause breaks in slope, some of which may be unknown, or at least unknown to the interpreter. In some cases, the relationship between the cumulative variable may not be linear, so some caution must be used.

This technique can also be used to check consistency in data, such as the comparison of one rain gage or (stream gage) to other nearby gages.

For a more complete discussion see Dalen et al. (1973).

B. Sediment Delivery to the Coast

Since measurements of sediment are nearly always made within a few miles of the coast, this is not, in general, a difficult problem. However, in some cases, such as in the Santa Margarita River and many creeks in the San Diego Region, the stream discharges to a lagoon or marsh, and the sediment delivery to the coast is much less than that measured a few miles inland. In the case of the Santa Margarita River, a berm normally forms and is only broken in high flows, so that much of the sediment eventually gets to the coast, but not necessarily at the same time as was measured.

In these case, the good solution is to make surveys near the stream terminus. As this is an expensive operation, care should be taken in selecting rivers for survey. Brownlie (1981) found that, for example, Calleguas Creek discharges considerably more sand and gravel to the coast than do any of the streams in the San Diego Region. Despite the fact that Calleguas Creek ends in a lagoon, it might be chosen for study before a stream in the San Diego Region, simply because it is likely to be a more significant source of sediment.

C. Streamflow at the Coast

This problem is somewhat less difficult than the previous, in that nearly all the water which passes the last gage arrives at the coast. The problem is usually one of determining losses (such as diversions, ground water, recharge etc.) and additional runoff from the unmeasured drainage area. In almost all cases, except small streams, the additional drainage area is small and the additional runoff can de determined using rainfall records in the unmeasured drainage area.

For small streams, and streams which are unmeasured, estimates must be made, again using rainfall records for the region. Determining runoff can be tricky, and it helps to have a similar gaged watershed nearby, since that makes estimates of soil moisture effects, ground cover effects, and slope effects somewhat easier. Double-mass analysis of rainfall-streamflow may also be of use here.

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APPENDIX A

SAN DIEGO REGION

CONTENTS

1. Pertinent stream gages in the San Diego Region

REGION:
SAN DIEGO

STREAMS:
SAN DIEGO RIVER, SWEETWATER RIVER, OTAY RIVER, TIJUANA RIVER

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA MI²	REMARKS
X5-1230	11-0225.00	SAN DIEGO R. NEAR SANTEE.	USGS	32-49-29 117-03-17	R	1912	PRESENT	JAN.-FEB. 1916, 1924	377.0	1912-1920 NON-RECORDING
X5-1100	11-0230.00	SAN DIEGO R. AT SAN DIEGO	USGS	32-45-30 117-12-12	F	1912	1916		432.0	
X6-1200	11-0165.00	SWEETWATER RIVER	USGS	32-41-18 117-00-36	F	1887	1966		182.0	
		SWEETWATER RIVER	SDC (593)	32-41 117-00	R	1970	PRESENT		182.0	
X7-1300	11-0145.50	OTAY RIVER	USGS + SDC (596)	32-36-30 116-55-42	F	1936	1959		99.0	
						1972	PRESENT		99.0	
X8-1100	11-0135.00	TIJUANA R.	USGS	32-33-06 117-05-00	F	1914	1915		1695.0	
					R	1936	1982		1695.0	

R = RECORDING

F = DAILY FLOW

REGION:
SAN DIEGO

STREAMS:
ESCONDIDO CREEK, LOMA ALTA, BUENA VISTA CREEK.

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA Mi²	REMARKS
X3-1022	–	LOMA ALTA CR.	SDC (576)	33-11-18 117-21-38	R	1972	PRESENT		8.5	
X3-1070		BUENA VISTA CREEK	SDC (564)	33-12-18 117-14-06	R	1962			4.2	
–	–	SAN MARCOS CREEK	SDC (568)		R	1972				COMBINE
X4-3055	–	SAN MARCOS CREEK TRB.	SDC (587)	33-07-48 117-13-18	F	1960	PRESENT		0.5	COMBINE
X4-3150	11-0307.30	ESCONDIDO CREEK	SDC (594)	33-03-02 117-12-49	R	1971	1978		64.0	DESTROYED, 1978
X4-3420	–	ESCONDIDO CR AT HARMONY GROVE RD.	SDC (566)	33-06-30 117-06-36	R	1970	PRESENT		47.0	

R = RECORDING

F = DAILY FLOW

REGION:
SAN DIEGO

STREAMS:
SAN CLEMENTE CANYON, SAN DIEGO GROUPS

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA Mi²	REMARKS
X5-1150		ALVARADO CANYON	SDC (582)	32-46-42 117-06-00	F	1964	PRESENT		8.8	
X5-6100		TECOLOTE CANYON	SDC (578)	32-46-24 117-12-18	C	1964			9.2	
X5-6310		ROSE CANYON	SDC (586)	32-49-24 117-13-42	F	1966			35.0	
X5-6410	11-0232.00	SAN CLEMENTE CANYON	SDC (569)	32-52-28 117-05-52	R	1973			5.6	
X5-6680	11-0233.40	LOS PEÑASQUITOS	USGS (SDC 241)	32-56-36 117-07-12	R	1964			42.0	
X5-6810		CHOLLAS CR.	SDC (574)	32-42-06 117-07-17	F	1966	PRESENT		14.0	
X6-3100	11-0147.00	TELEGRAPH CANYON	SDC (583)	32-37-04 117-04-28	R	1972	1973		6.2	

C=CONTINUOUS
R=RECORDING
F=DAILY FLOW

REGION:
SAN DIEGO

STREAMS:
SANTA MARGARITA R., SAN LUIS REY R., SAN DIEGUITO R.

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
X2-1100	11-0460.00	SANTA MARGARITA	USGS (SDC 279)	33-14-13 117-23-14	R	1923	PRESENT		740.0	
X3-1100	11-0420.00	SAN LUIS REY	USGS (SDC 271)	33-12-48 117-22-33	R	1912	PRESENT	1914-1928 1942-1946	560.0	1912-1928 NON-RECORDING
X3-1175	11-0410.00	SAN LUIS REY	USGS	33-15-13 117-14-48	R	1916	1979		513.0	
X4-1120	11-0395.00	SAN DIEGUITO	USGS	32-59-54 117-12-12	F	1913	1914		326.0	
X4-1200	11-0300.00	SAN DIEGUITO	SDC (591)	33-02-48 117-03-30	R	1916	1968		303.0	1916-1968 USGS (F) 1969-SDC

R= RECORDING

F= DAILY FLOW

REGION:
SAN DIEGO

STREAMS:
SAN JUAN CREEK, SAN ONOFRE CREEK, SAN MATEO CREEK, LAS FLORES CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
X1-1100	11-0465.00	SAN JUAN CR.	USGS	33-29-30 117-39-42		1928	1969		117.0	
X1-1040	11-0465.50	SAN JUAN CR.		33-29-30 117-39-44	R	1969	PRESENT		117.0	
X1-2100	11-0470.00	ARROYO TRABUCO	OC(5)	33-31-35 117-40-08	R	1930	PRESENT		35.7	
X1-4070	11-0463.70	SAN MATEO CR.	USMC 285	33-23-48 117-35-18	R	1946	1967		132.0	
X1-5100	11-0462.00	SAN ONOFRE CREEK	USMC 282	33-23-00 117-34-24	R	1946	1967		42.0	
X1-6100	11-0461.00	LAS FLORES CREEK	USGS	33-17-32 117-27-21	R	1951	1979	1977	27.0	

R = RECORDING
F = DAILY FLOW

2. Stream gages in San Diego County, with location map. From the San Diego County Flood Control District

SAN DIEGO COUNTY

STREAMFLOW DATA STATIONS

STATION NAME	MAP NO.	GAGE TYPE*	ELEV.	OBSERVER	1977-78 PEAK FLOW CFS	1977-78 PEAK FLOW DATE	RECORD BEGINS	1978-79 PEAK FLOW CFS	1978-79 PEAK FLOW DATE
Agua Caliente Creek near Warner Springs	250	RG	2,950	USGS	583	3/1	2/61	183	3/28
Agua Caliente Creek Trib. near Warner Springs	233	C	3,240	COSD	Blocked		12/61	Removed	
Alvarado Canyon Creek @ I-8 & Waring Road	582	C	85	COSD	1400	3/6	10/64	4500	1/31
Alvarado Canyon Creek Trib. @ Montezuma Road	580	C	100	COSD	400	3/6	10/64	360	1/31
Beeler Creek near Poway	570	RD	460	USGS	1080	3/4	8/70	237	1/31
Blossom Valley Creek @ Flinn Springs Road	571	C	865	COSD	190	3/6	10/63	380	1/31
Borrego Palm Creek near Borrego Springs	251	RD	1,200	USGS	87	2/28	10/50	2 2640	8/16
Buena Vista Creek in Wildwood Park	564	RG	335	COSD	184	1/15	8/62	90	1/31
Campo Creek near Campo	252	RD	2,179	USGS	74	3/2	10/36	59	3/28
Cedar Creek near Jamul	220	C	675	COSD	540	3/6	11/61	320	1/31
Chariot Creek near Julian	226	C	2,800	COSD	12	---	12/61	5	---
Chollas Creek @ Wabash Blvd. & Oceanview Blvd.	574	C	10	COSD	Removed		10/66	---	---
Clevenger Creek Trib. near Ramona	232	C	1,245	COSD	Blocked		12/61	32	1/31
Cottonwood Creek above Tecate Creek	253	RD	567	USGS	1910	3/1	10/36	494	3/28
Coyote Creek near Borrego Springs	256	RD	1,250	USGS	650	3/1	10/50	520	8/16
Cristianitos Creek near San Clemente	284	RG	165	USMC	Ref USMC		10/50	---	
De Luz Creek near Fallbrook	278	RG	150	USMC	Ref USMC		2/51	---	
Escondido Creek @ Harmony Grove Road	566	RG	615	COSD	4447	1/15	2/70	1293	3/1
Escondido Creek @ Lake Wohlford	595	RDT	1,485	COSD			1/72		
Escondido Creek in Olivenhain	594	RD	80	COSD	Destroyed		7/71	---	
Fallbrook Creek near Lake O'Neill	224	RG	200	USMC	Ref USMC		2/65	---	
Forester Creek @ Cuyamaca Street	565	RG	345	COSD	n/a		4/65	4000+	1/31

*RG - Recording-Graphic
RD - Recording-Digital
C - Crest Stage
RDT - Recording-Digital-Telemetered

season:
oct 1 to sep 30

SAN DIEGO COUNTY

STREAMFLOW DATA STATIONS

STATION NAME	MAP NO.	GAGE TYPE*	ELEV.	OBSERVER	1977-78 PEAK FLOW CFS	1977-78 PEAK FLOW DATE	RECORD BEGINS	1978-79 PEAK FLOW CFS	1978-79 PEAK FLOW DATE
Arroyo Creek near San Pasqual	254	RD	560	USGS	1950	3/1	12/46	1020	3/28
Harbison Canyon Creek @ Dehesa Road	572	C	560	COSD	350	3/6	10/64	250	1/31
Jamul Creek near Jamul	260	RD	512	USGS	3650	3/1	4/40	Removed	
Jamul Creek Trib. near Jamul	589	RD	1,000	COSD	178	3/5	2/73	51	2/22
Japacha Creek near Descanso	230	C	4,070	COSD	68	3/5	12/61	52	---
Keys Creek Trib. @ Valley Center Road	289	RD	1,280	USGS	1050	3/4	8/63	318	3/28
Lake Hodges Trib. near Escondido	222	C	550	COSD	Removed		12/61	---	
Las Flores Creek near Oceanside	280	RD	35	USGS	Removed		5/51	---	
Loma Alta Creek @ I-5	576	RG	25	COSD	383	1/14	9/72	21	1/31
Los Coches Creek @ Old Highway 80	561	RG	554	COSD	1000	3/5	11/68	1500	1/31
Los Penasquitos Creek @ Booler Creek	247	RD	413	USGS	3530	3/1	8/70	1500	1/6
Los Penasquitos Creek near Poway	241	RD	260	USGS	4700	3/1	10/64	1390	1/6
Moosa Canyon Creek @ Artesian Lake	567	C	390	COSD	900	3/1	3/70	500	1/6
Murphy Canyon Creek @ Clairemont Mesa Blvd.	579	C	250	COSD	750	3/5	10/64	450	1/31
Otay River @ Lower Otay Reservoir	596	RDT	490	COSD	No Overflow		1/72	No Overflow	
Pauma Creek near Pauma Valley	287	RG	1,240	USGS	625	3/2	10/64	700	3/28
Pinyon Wash near Borrego	237	C	1,400	COSD	Damaged		1/60	---	
Pomerado Creek @ Poway Road	243	RD	446	USGS	Closed 1977		8/70	---	
Potrero Creek Trib. near Barrett Junction	228	C	1,400	COSD			2/66		
Poway Creek near Garden Road	244	RD	546	USGS			8/70		
Poway Creek Trib. @ Oak Knoll Road	245	RD	440	USGS	Closed 1974		8/70	---	
Powerhouse Canyon Creek @ Pershing Drive	584	C	80	COSD			10/64		

*RG - Recording-Graphic
RD - Recording-Digital
C - Crest Stage
RDT - Recording-Digital-Telemetered

season:
oct 1 to sep 30

STREAMFLOW DATA STATIONS

STATION NAME	MAP NO.	GAGE TYPE*	ELEV.	OBSERVER	1977-78 PEAK FLOW CFS	1977-78 PEAK FLOW DATE	RECORD BEGINS	1978-79 PEAK FLOW CFS	1978-79 PEAK FLOW DATE
Rattlesnake Creek @ Poway Creek	246	RD	445	USGS	285	1/10	8/70	271	12/18
Rattlesnake Creek near Poway	221	C	570	COSD	5	---	12/61	1	---
Reidy Canyon Creek Trib. @ Jesmond Dene Road	573	C	745	COSD	1400	1/15	10/63	1200	3/1
Rose Canyon Creek @ Jutland Drive	586	C	50	COSD	7280	1/15	10/66	3666	3/1
San Clemente Canyon Creek @ Miramar	569	RD	500	COSD	455	1/14	3/73	230	1/31
San Diego River @ El Capitan Reservoir	590	RDT	770	COSD	No Overflow		9/70	No Overflow	
San Diego River near Santee	263	RDT	180	USGS	3010	1/15	5/12	2690	1/31
San Dieguito River @ Lake Hodges	591	RDT	330	COSD	4000	3/5	9/70	2000	3/28
San Felipe Creek near Julian	255	RD.	1,873	USGS	126	3/5	8/58	94	3/28
San Luis Rey River @ Monsorate Narrows	270	RGT	271	USGS	4340	1/17	12/35	2150	3/28
San Luis Rey River @ Oceanside	271	RG	20	USGS	9780	1/17	4/12	5100	3/28
San Luis Rey River near Bonsall	286	RD	108	USGS	8230	1/17	7/16	4590	3/28
San Luis Rey River Trib. in Live Oak Park	588	C	525	COSD	Damaged		9/60	---	
San Luis Rey River Trib. near Pala	234		500		12	---	12/61	8	---
San Luis Rey River Trib. No. 2 near Fallbrook	223	C	500	COSD	100	---	12/61	15	---
San Marcos Creek @ Lake San Marcos	568	RD	500	COSD			4/72		
San Marcos Creek Trib. near Palomar Airport Road	587	C	395	COSD	380	1/17	10/60	280	3/1
San Mateo Creek @ San Onofre	285	RG	20	USMC	Ref USMC		10/46	Ref USMC	
San Mateo Creek near San Clemente	283	RG	405	USMC	Ref USMC		10/52	Ref USMC	
San Mateo Creek Trib. near San Onofre	225	C	190	USMC	"	"	12/61	"	"
San Onofre Creek @ San Onofre	282	RG	15	USMC	"	"	10/46	"	"
San Vicente Creek @ San Vicente Reservoir	592	RDT	659	COSD	2400	3/5	10/70	No Overflow	

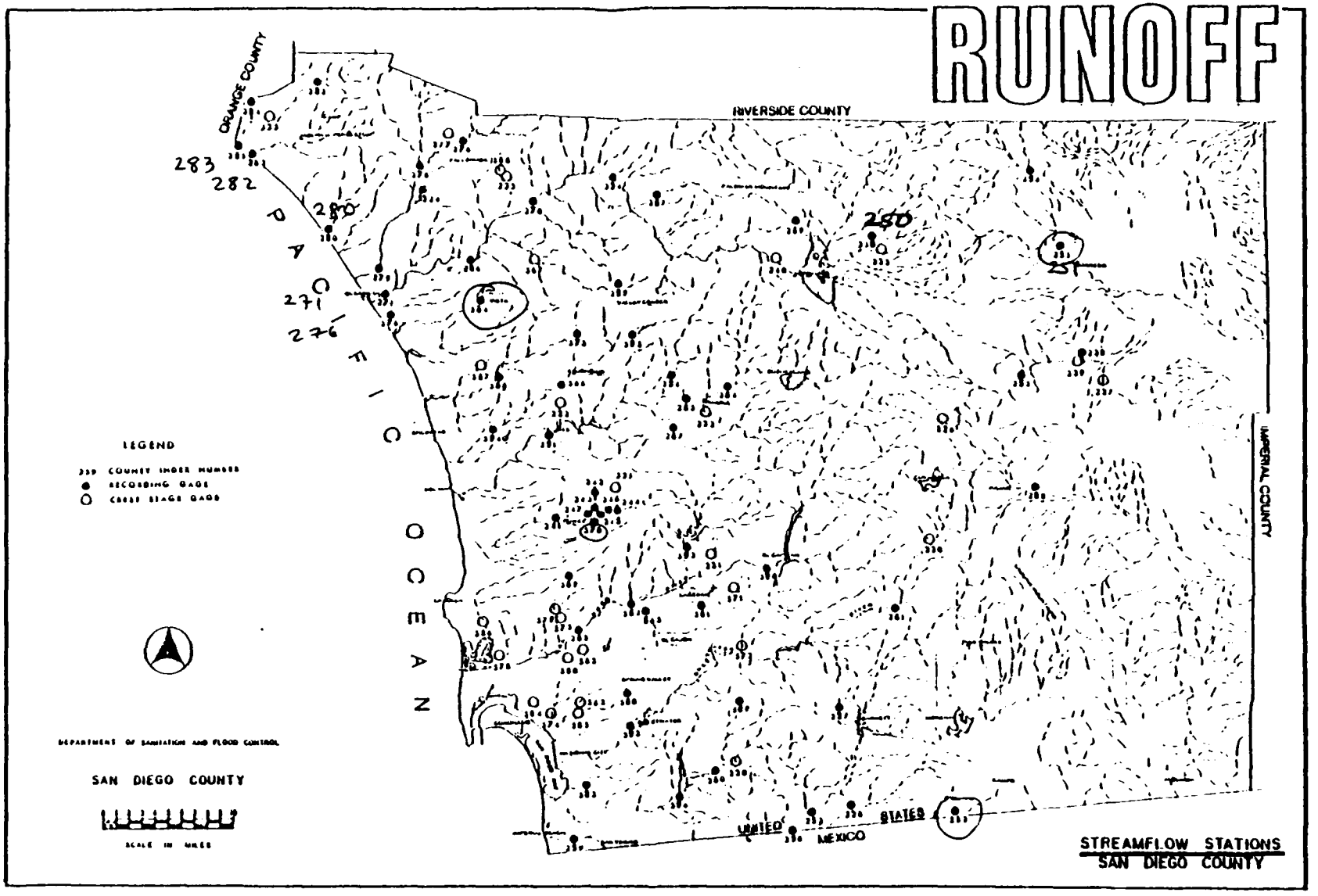
*RG - Recording-Graphic
RD - Recording-Digital
C - Crest Stage
RDT - Recording-Digital-Telemetered
RGT - Recording-Graphic-Telemetered

SAN DIEGO COUNTY

STREAMFLOW DATA STATIONS

STATION NAME	MAP NO.	GAGE TYPE*	ELEV.	OBSERVER	1977-78 PEAK FLOW CFS	1977-78 PEAK FLOW DATE	RECORD BEGINS	1978-79 PEAK FLOW CFS	1978-79 PEAK FLOW DATE
Santa Margarita River @ Ysidora	279	RG	10	USGS	21,200	3/1	2/23	Not Reported	
Santa Margarita River near Fallbrook	276	RD	280	USGS	22,000	3/1	10/24	6000	1/6
Santa Margarita River Trib. near Fallbrook	277	C	750	CoSD	Closed 1974		12/61	---	
Santa Maria Creek near Ramona	267	RD	1,294	USGS	2850	3/5	11/12	1030	1/31
Santa Ysabel Creek near Ramona	264	RD	848	USGS	4000	3/1	12/12	2180	3/28
Santa Ysabel Creek near San Pasqual	265	RD	510	USGS	4310	3/1	12/05	2310	3/28
Shepherd Canyon Creek @ Murphy Canyon Road	575	C	190	COSD	350	3/5	10/65	Removed	
South Chollas Creek Trib. @ Euclid Ave. & Market St.	585	C	110	COSD	No Record		10/66	784	1/31
South Chollas Creek Trib. @ Lenox Drive	563	C	155	COSD	Closed 1974		5/69	---	
Spring Valley Creek in Goodland Acres Park	560	RG	330	COSD	412	1/15	9/62	437	1/30
Sweetwater River near Descanso	261	RG	3,269	USGS	1150	3/2	10/05	958	3/28
Sweetwater River @ Sweetwater Reservoir	593	RDT	250	COSD	No Overflow		11/70	1200+	3/29
Sycamore Canyon Creek @ Carlton Oaks Drive	562	RG	325	COSD	1616	1/15	12/71	1209	1/31
Tecolote Creek @ Morena Blvd.	578	C	10	COSD	248	1/15	10/64	77	---
Telegraph Canyon Creek @ 4th Ave.	583	RDT	75	COSD	106	1/16	7/72	44	11/25
Tia Juana River near Dulzura	258	RD	542	USGS	3000	3/1	10/36	978	3/28
Tia Juana River near Nestor	259	RGT	15	USGS	6370	3/1	10/14	1610	3/29
Vallecito Creek near Julian	288	RD	1,950	USGS	2.3	3/1	10/63	0.3	8/16
West Fork San Luis Rey River near Warner Springs	269	RD	2,800	USGS	2590	3/4	1/13	930	3/28
Wigham Creek near Lake Henshaw	240	C	2,520	CoSD	70	3/4	1/65	17	3/28
Wildcat Creek near Lakeside	231	C	1,100	CoSD	11	---	12/61	No Reading	
Wilson Creek Trib. near Dulzura	227	C	2,150	CoSD	47	---	12/61	20	---
Yaqui Pass Wash near Borrego	238	C	1,720	CoSD	0		1/60	0	
Yaqui Pass Wash No. 2 near Borrego	239	C	1,780	CoSD	0		1/60	0	

RUNOFF


ORANGE COUNTY
RIVERSIDE COUNTY
IMPERIAL COUNTY
283
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271
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PACIFIC OCEAN
UNITED STATES
MEXICO
LEGEND
COUNTY INDEX NUMBER
RECORDING GAGE
CREST STAGE GAGE
DEPARTMENT OF SANITATION AND FLOOD CONTROL
SAN DIEGO COUNTY
SCALE IN MILES
STREAMFLOW STATIONS
SAN DIEGO COUNTY

3. Stream gages in Orange County, with location map. From the Orange County Environmental Management Agency

ORANGE COUNTY ENVIRONMENTAL MANAGEMENT AGENCY

ACTIVE STREAM-GAGING STATIONS

OCEMA DISCHARGE SUMMARY

OCEMA NUMBER	STATION NAME	MOMENTARY PEAK		MAXIMUM DAY	MINIMUM DAY	MEAN DAILY	TOTAL VOLUME
		L/S	DATE	L/S	L/S	L/S	DAM³
2	Fullerton Creek at Richman Avenue, Fullerton	78100	03-01-83	22900	5	403	12560
4	Aliso Creek near Jeronimo Road, El Toro	47300	02-27-83	4390	0	118	3670
5	Arroyo Trabuco at Camino Capistrano	69300	02-27-83	12600	0	698	21900
122	Santa Ana River at Imperial Highway	248000	03-01-83	15800	550	16100	507000
152	Alameda Storm Channel, Orange	42200	03-01-83	7730	0	-	-
207	Westminster Channel at Beach Blvd.	41900	03-01-83	7900	0	-	-
211	Brea Creek at Darlington Avenue, Buena Park	50300	03-01-83	16700	17	362	12100
213	Carbon Canyon Diversion Channel, Anaheim	-	-	-	0	-	-
214	Santiago Creek at Villa Park Dam	34000	03-03-83	22700	0	860	27300
216	El Modena - Irvine Channel at Myford Road	142000	03-01-83	22900	17	281	8870
217	East Garden Grove - Wintersburg Channel, Huntington Beach	34000	03-01-83	24200	8	430	13500
218	Oso Creek at Crown Valley Parkway, Mission Viejo	139000	02-27-83	17400	12	367	11500
220	Santa Ana - Delhi Channel at Irvine Avenue	123000	03-01-83	39300	16	467	16300
222	Laguna Canyon Channel at Woodland Drive	39600	03-01-83	3820	5	89	2800

USGS HISTORICAL DISCHARGE SUMMARY

STATIONS IN OR AFFECTING ORANGE COUNTY

STATION NAME	DRAINAGE AREA	PERIOD OF RECORD		HISTORICAL DATA					
				MOMENTARY PEAK		TOTAL RUNOFF IN DAM³			
	Km²	FROM	TO	L/S	DATE	MAXIMUM	YEAR	MINIMUM	YEAR
Brea creek below Brea Dam	55.9	1941	*	48100	02-18-80	18700	1980	1	1951
Carbon Creek below Carbon Dam	50.5	1961	*	12600	02-25-69	32900	1962	3	1972
Fullerton Creek below Fullerton Dam	12.8	1941	*	8860	01-25-69	3610	1980	0	1951
San Diego Creek near Irvine	104	1949	*	218000	02-16-80	31300	1980	0	1951
San Juan Creek at San Juan Capistrano	303	1969	*	634000	02-25-69	132000	1980	533	1972
San Juan Creek at San Juan Capistrano	274	1928	1968	368000	03-02-38	61700	1941	0	1951
Santa Ana River below Prado Dam	3860	1940	*	211000	02-21-80	151000	1980	34700	1961
Prior to Prado Dam Construction	3860	1930	1939	2830000	03-02-38	14700	1938	16100	1939
Santa Ana River at Santa Ana	4400**	1923	*	#1131000	03-02-38	500000	1980	108	1951
Santiago Creek at Modjeska	32.4	1961	*	184000	03-02-38	47000	1969	193	1963
Santiago Creek at Santa Ana	246	1928	*	187000	02-25-69	64000	1969	30	1961

* Station currently collecting data

** Excludes 2,000 km^2 above Lake Elsinore

\# Approximately 1.7 million L/S is not included because it broke out at the river channel upstream at the gaging station

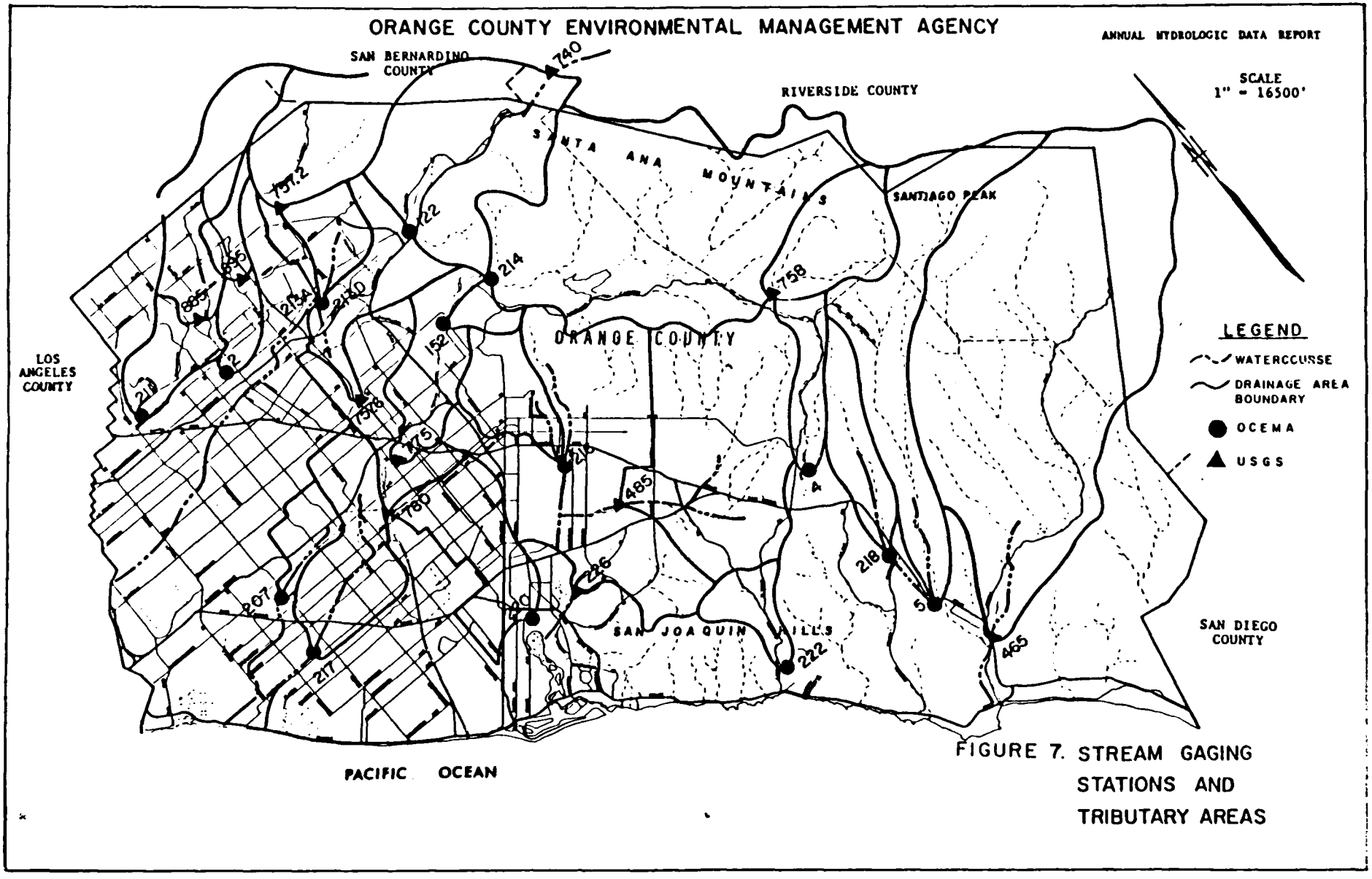
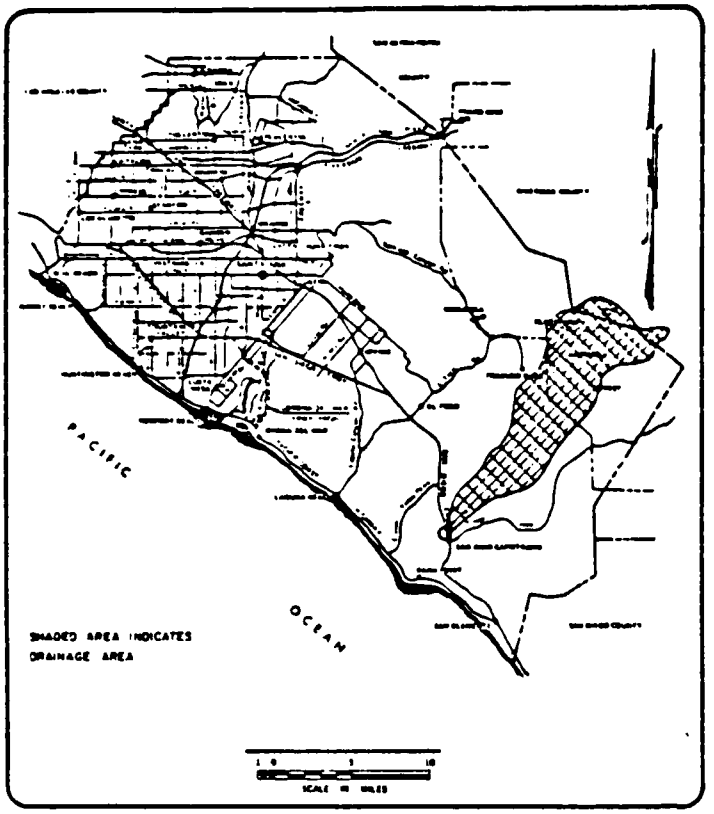


FIGURE 7. STREAM GAGING STATIONS AND TRIBUTARY AREAS



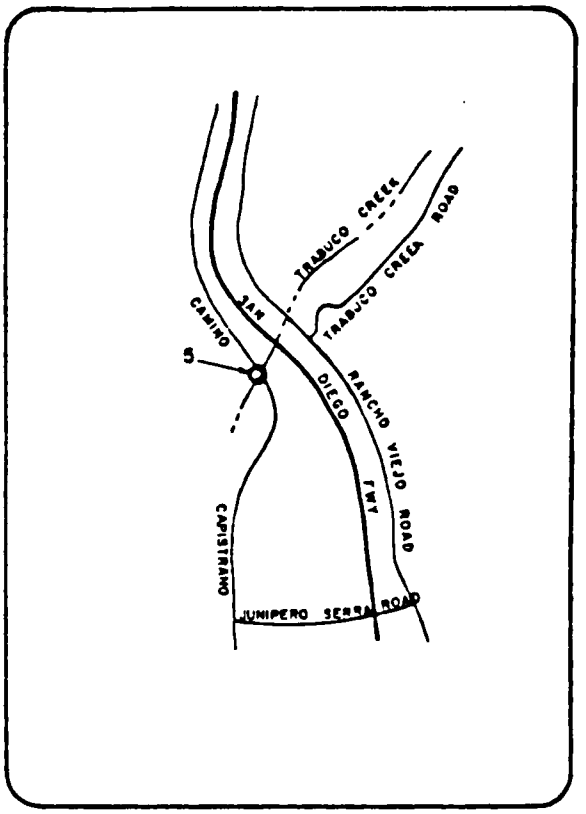


FIGURE 10.

STATION NO. 5
ARROYO TRABUCO AT CAMINO CAPISTRANO NEAR SAN JUAN CAPISTRANO

LOCATION: LATITUDE 33°31'35", LONGITUDE 117°40'08", APPROXIMATELY 122m (400ft) DOWNSTREAM OF SAN DIEGO FREEWAY BRIDGE, 2.9×10^3m (1.8mi) NORTH OF SAN JUAN CAPISTRANO.

DRAINAGE AREA: $96 \times 10^6 m^2$ (35.7 sq mi).

GAGE: FLOAT OPERATED DUAL PEN WATER-STAGE RECORDER. GAGE ELEVATION 54m (177ft) MSL.

CHANNEL: DOUBLE RECTANGULAR CONCRETE.

PERIOD OF RECORD: OCTOBER 1932 TO PRESENT.

REMARKS: MOST LOW FLOWS CONSERVED IN SEVERAL SMALL RESERVOIRS ABOVE GAGE.

4. U.S. Geological Survey descriptions of major stream gages from U.S.G.S. publications

TIJUANA RIVER BASIN

11013500 TIJUANA RIVER NEAR NESTOR, CA

LOCATION.--Lat 32°33'06", long 117°05'00", on line between secs.3 and 4, T.19 S., R.2 W., San Diego County, Hydrologic Unit 18070305, on downstream side of Hollister Street bridge, 1.7 mi (2.7 km) south of Nestor, and 2.9 mi (4.7 km) upstream from mouth at Pacific Ocean.

DRAINAGE AREA.--1,695 mi² (4,390 km²), of which 1,236 mi² (3,201 km²) are in Mexico.

PERIOD OF RECORD.--October 1914 to September 1915, October 1936 to December 1981 (discontinued).

GAGE.--Water-stage recorder. Datum of gage is 15.14 ft (4.615 m) National Geodetic Vertical Datum of 1929. See WSP 1735 for history of changes prior to Aug. 5, 1958.

REMARKS.--Records poor. Flow regulated by Morena Reservoir, capacity, 50,210 acre-ft (61.9 hm³) and Barrett Reservoir, capacity, 44,760 acre-ft (55.2 hm³) in the United States, and Rodriguez Reservoir (station 11013200) in Mexico. Water diverted from Cottonwood Creek at Barrett Dam by Dulzura conduit to Jamul Creek. AVERAGE DISCHARGE represents flow to the ocean regardless of upstream development.

COOPERATION.--The International Boundary and Water Commission provided gage-height record for period Oct. 1 to Dec. 31.

AVERAGE DISCHARGE.--46 years, 45.8 ft³/s (1.30 m³/s), 33,180 acre-ft/yr (40.9 hm³/yr).

EXTREMES FOR PERIOD OF RECORD (SINCE 1936).--Maximum discharge, 33,500 ft³/s (949 m³/s) Feb. 21, 1980, gage height, 8.70 ft (2.652 m), affected by channel outbreak; maximum gage height, 11.50 ft (3.505 m) Jan. 30, 1980, prior to channel outbreak and major river movement caused by February 1980 floods; no flow parts of each year.

EXTREMES FOR PERIOD.--Maximum discharge, unknown, maximum gage height, 4.16 ft (1.268 m) Nov. 28; no flow many days.

135. Tia Juana River near Nestor, Calif.

Location.--Lat 32°33'05", long 117°05'00", on line between secs.3 and 4, T.19 S., R.2 W., on downstream side of county highway bridge, 1.7 miles south of Nestor and 2.9 miles upstream from mouth.

Drainage area.--1,695 sq mi, of which 1,198 sq mi is in Mexico.

Records available.--October 1914 to September 1915, October 1936 to September 1960.

Gage.--Water-stage recorder. Datum of gage is 15.14 ft above mean sea level. Oct. 1, 1914, to Sept. 30, 1915, reference point at same site at mean sea level datum. Oct. 1, 1936, to Apr. 9, 1953, water-stage recorder at different datum. Apr. 10, 1953, to Aug. 5, 1958, at site 2 miles upstream at different datum.

Average discharge.--25 years (1914-15, 1936-60), 44.5 cfs (32,220 acre-ft per year); median of yearly mean discharges, 8.0 cfs (5,800 acre-ft per year).

Extremes.--1936-60: Maximum discharge, 17,700 cfs Feb. 7, 1937 (gage height, 8.20 ft, at different datum), from rating curve extended above 2,000 cfs on basis of velocity-depth relation and cross section after peak; no flow for parts of each year.

Remarks.--Flow regulated by Morena and Barrett Reservoirs in the United States, and Rodriguez Reservoir (see preceding page) in Mexico. Water diverted from Cottonwood Creek at Barrett Dam by Dulzura conduit to Jamul Creek.

TIJUANA RIVER BASIN

11013500 TIJUANA RIVER NEAR NESTOR, CA

LOCATION.--Lat 32°33'06", long 117°05'00", on line between secs.3 and 4, T.19 S., R.2 W., San Diego County, Hydrologic Unit 18070305, on downstream side of Hollister Street bridge, 1.7 mi (2.7 km) south of Nestor, and 2.9 mi (4.7 km) upstream from mouth at Pacific Ocean.

DRAINAGE AREA.--1,695 mi² (4,390 km²), of which 1,236 mi² (3,201 km²) are in Mexico.

PERIOD OF RECORD.--October 1914 to September 1915, October 1936 to December 1981 (discontinued).

GAGE.--Water-stage recorder. Datum of gage is 15.14 ft (4.615 m) National Geodetic Vertical Datum of 1929. See WSP 1735 for history of changes prior to Aug. 5, 1958.

REMARKS.--Records poor. Flow regulated by Morena Reservoir, capacity, 50,210 acre-ft (61.9 hm³) and Barrett Reservoir, capacity, 44,760 acre-ft (55.2 hm³) in the United States, and Rodriquez Reservoir (station 11013200) in Mexico. Water diverted from Cottonwood Creek at Barrett Dam by Dulzura conduit to Jamul Creek. AVERAGE DISCHARGE represents flow to the ocean regardless of upstream development.

COOPERATION.--The International Boundary and Water Commission provided gage-height record for period Oct. 1 to Dec. 11.

AVERAGE DISCHARGE.--46 years, 45.8 ft³/s (1.30 m³/s), 33,180 acre-ft/yr (40.9 hm³/yr).

EXTREMES FOR PERIOD OF RECORD (SINCE 1936).--Maximum discharge, 33,500 ft³/s (949 m³/s) Feb. 21, 1980, gage height, 8.70 ft (2.652 m), affected by channel outbreak; maximum gage height, 11.50 ft (3.505 m) Jan. 30, 1980, prior to channel outbreak and major river movement caused by February 1980 floods; no flow parts of each year.

EXTREMES FOR PERIOD.--Maximum discharge, unknown, maximum gage height, 4.16 ft (1.268 m) Nov. 28; no flow many days.

TIJUANA RIVER BASIN

11013500 TIJUANA RIVER NEAR NESTOR, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1969 to September 1978 (discontinued).
SEDIMENT RECORDS: October 1969 to September 1978 (discontinued).

REMARKS.--Sediment table omitted for no flow periods October to December and July to September.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 10,000 mg/L Mar. 1, 1978; minimum daily mean, no flow for many days each year.
SEDIMENT DISCHARGE: Maximum daily, 122,000 tons (111,000 metric tons) Mar. 1, 1978; minimum daily, 0 tons for many days each year.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 10,000 mg/L Mar. 1; minimum daily mean, no flow for many days.
SEDIMENT DISCHARGE: Maximum daily, 122,000 tons (111,000 metric tons) Mar. 1; minimum daily, 0 tons for many days.

SAN DIEGO RIVER BASIN

11022500 SAN DIEGO RIVER NEAR SANTEE, CA

LOCATION.--Lat 32°49'29", long 117°03'17", in Ex Mission San Diego Grant, San Diego County, Hydrologic Unit 18070304, on right bank in Mission Gorge, 0.2 mi (0.3 km) upstream from left tributary, 6 mi (10 km) west of Santee, and 18 mi (29 km) downstream from El Capitan Reservoir.

DRAINAGE AREA.--377 mi^2 (976 km^2).

PERIOD OF RECORD.--May 1912 to December 1915, March 1916 to current year. Monthly discharge only for some periods and yearly estimates only for 1924-25, published in WSP 1315-B.

GAGE.--Water-stage recorder. Altitude of gage is 180 ft (54.9 m), from topographic map. Prior to Nov. 10, 1920, nonrecording gage at site 1.5 mi (2.4 km) upstream at different datum. Nov. 10, 1920, to Dec. 1, 1954, water-stage recorder at present site at datum 1.0 ft (0.30 m) higher.

REMARKS.--Records good. Flow regulated by Cuyamaca Reservoir, capacity, 11,540 acre-ft (46.7 hm^3), El Capitan Reservoir (station 11020500), and San Vicente Reservoir (station 11022000). Diversions by city of San Diego for municipal supply and by Helix Irrigation District. AVERAGE DISCHARGE represents flow to ocean during period of record, regardless of upstream development.

AVERAGE DISCHARGE.--68 years (water years 1913-15, 1917-81), 24.9 ft^3/s (0.705 m^3/s), 18,040 acre-ft/yr (22.2 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 70,200 ft^3/s (1,990 m^3/s) Jan. 27, 1916, based on slope-conveyance computation of peak flow, gage height, 25.1 ft (7.651 m), from floodmarks, site and datum then in use; no flow at times in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,370 ft^3/s (38.8 m^3/s) Jan. 28; gage height, 8.50 ft (2.591 m), from rating curve extended above 200 ft^3/s (5.66 m^3/s); minimum daily, 1.2 ft^3/s (0.034 m^3/s) July 6.

SAN DIEGO RIVER BASIN

11022500 SAN DIEGO RIVER NEAR SANTEE, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1970 to September 1978 (discontinued).
SEDIMENT RECORDS: October 1969 to September 1978 (discontinued).

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 830 mg/L Jan. 15, 1978; minimum daily mean, 0 mg/L on many days in July and August, 1976 and August, 1977.
SEDIMENT DISCHARGE: Maximum daily, 3,230 tons (2,930 metric tons) Jan. 15, 1978; minimum daily, 0 tons on many days in 1969, 1970, 1976 and 1977.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 830 mg/L Jan. 15; minimum daily mean, 2 mg/L on several days during December.
SEDIMENT DISCHARGE: Maximum daily, 3,230 tons (2,930 metric tons) Jan. 15; minimum daily, 0.01 tons (0.01 metric tons) many days during October, November, and December.

SAN DIEGUITO RIVER BASIN

11030020 LAKE HODGES NEAR ESCONDIDO, CA

LOCATION.--Lat 33°02'41", long 117°07'39", in SE¼SE¼NW¼ sec.18, T.13 S., R.2 W., San Diego County, Hydrologic Unit 18070304, 20 ft (6 m) upstream from right upstream end of Hodges Dam on San Dieguito River, 6.4 mi (10.3 km) southwest of Escondido, and 20 mi (32 km) southwest of Sutherland Reservoir.

DRAINAGE AREA.--303 mi² (785 km²).

PERIOD OF RECORD.--October 1945 to September 1968 (published with San Dieguito River at Lake Hodges, station 11030000), October 1972 to current year. Records of monthend gage heights February 1919 to September 1945, in files of San Diego County Department of Sanitation and Flood Control.

GAGE.--Nonrecording gage. Datum of gage is 200.0 ft (60.96 m) National Geodetic Vertical Datum of 1929 (levels by county of San Diego); gage readings have been reduced to elevations NGVD. Prior to Oct. 1, 1972, nonrecording gage at site 800 ft (244 m) upstream on right bank at same datum. October 1972 to current year, supplementary water-stage recorder used for flood warning only on left upstream face of dam at same datum.

REMARKS.--Reservoir is formed by multiple-arch reinforced concrete dam, constructed in 1917-19. Storage began in February 1919. Capacity table based on a 1948 survey; table dated Sept. 18, 1951. Capacity of reservoir at spillway level, 33,550 acre-ft (41.4 hm³), elevation, 315.0 ft (96.01 m). Dead storage below lowest outlet, 1,160 acre-ft (1.43 hm³), elevation, 254.0 ft (77.42 m) included in these records. Reservoir can be drawn down to 207 acre-ft (255,000 m³), elevation, 240.0 ft (73.15 m) by pumping. Water drawn from Lake Hodges passes through a conduit to San Dieguito re-regulating reservoir, from which it is released as required for municipal use. Flow regulated since July 1954 by Sutherland Reservoir (station 11024000). Diversions for irrigation above Lake Hodges.

COOPERATION.--Gage heights were furnished by city of San Diego, Utilities Engineering Division.

EXTREMES FOR PERIOD OF RECORD (1945-68 AND SINCE 1972).--Maximum contents, 41,620 acre-ft (51.3 hm³), spilling, Feb. 21, 1980, elevation, 321.50 ft (97.993 m); minimum, 114 acre-ft (141,000 m³) Oct. 31, 1965, elevation, 235.80 ft (71.872 m).

EXTREMES FOR CURRENT YEAR.--Maximum contents observed, 35,850 acre-ft (44.2 hm³), spilling, Mar. 18, elevation, 316.82 ft (96.567 m); minimum observed, 26,530 acre-ft (32.7 hm³) Nov. 26, elevation, 308.82 ft (94.128 m).

SAN DIEGUITO RIVER BASIN

300. San Dieguito River at Lake Hodges, Calif.

Location.--Lat 33°02'48", long 117°07'33", in [illegible] sec.18, T.13 S., R.2 W., on right bank 900 ft upstream from Lake Hodges Dam and 6.2 miles southwest of Escondido.

Drainage area.--303 sq mi.

Records available.--January 1916 to September 1960. Published as "near Bernardo" prior to October 1920 and as "near Escondido" October 1920 to September 1925.

Gage.--Staff gage read once daily. Datum of gage is 200.0 ft above mean sea level. Prior to January 1919, staff gage at same site at different datum (prior to completion of dam).

Remarks.--Records of total inflow represent all the water reaching Lake Hodges, including precipitation on the lake and supplemental water from Colorado River delivered through aqueduct of San Diego County Water Authority. Total inflow computed on basis of records of storage, release (draft), spill, leakage, and evaporation. Records of net inflow exclude supplemental water from Colorado River. Capacity and area ratings for lake are based on a resurvey in 1948. Monthly evaporation from lake surface computed on basis of evaporation from Colorado pan using coefficient of .75. Since October 1957 evaporation computed by mass-transfer method. Capacity of lake at spillway level (gage height, 315.00 ft.), 33,550 acre-ft. Dead storage, 1,160 acre-ft below lowest outlet at gage height 54.0 ft, included in these records. Water drawn from Lake Hodges passes through a conduit to San Dieguito reregulating reservoir, from which it is released as required for municipal use. Diversions for irrigation above Lake Hodges. Flow regulated since July 1954 by Sutherland Reservoir.

11042000 SAN LUIS REY RIVER AT OCEANSIDE, CA
(National stream-quality accounting network station)

LOCATION.--Lat 33°12'48", long 117°22'33", in SW¼SE¼SW¼ sec.14, T.11 S., R.5 W., San Diego County, Hydrologic Unit 18070303, on right bank 0.7 mi (1.1 km) upstream from bridge on Interstate Highway 5, 1.1 mi (1.8 km) upstream from mouth, and 1.2 mi (1.9 km) north of Oceanside.

DRAINAGE AREA.--558 mi² (1,450 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1912 to September 1914 (published as "near Oceanside"), January 1916, October 1929 to January 1942, October 1946 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 20 ft (6.1 m), from topographic map. April 1912 to September 1914, nonrecording gage at site 0.8 mi (1.3 km) upstream at different datum. January 1916, nonrecording gage 0.2 mi (0.3 km) downstream at different datum. Prior to Oct. 1, 1978, at datum 10.00 ft (3.048 m) lower.

REMARKS.--Records fair. Flow regulated by Lake Henshaw, capacity, 194,300 acre-ft (240 hm³) since 1923. Several diversions for irrigation and domestic use above station. AVERAGE DISCHARGE represents flow to ocean during period of record regardless of upstream development.

AVERAGE DISCHARGE.--50 years (water years 1913-14, 1930-41, 1947-82), 31.6 ft³/s (0.895 m³/s), 22,890 acre-ft/yr (28.2 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 95,600 ft³/s (2,710 m³/s) Jan. 27, 1916, from hydrograph based on discharge measurements; no flow for several months in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,730 ft³/s (162 m³/s) Mar. 18, gage height, 10.78 ft (3.286 m); minimum daily, 4.1 ft³/s (0.116 m³/s) Aug. 7, 8.

SAN LUIS REY RIVER BASIN

42C. San Luis Rey River at Oceanside, Calif.

Location.--Lat 33°12'48", long 117°22'33", in SW¼SE¼SW¼ sec.14, T.11 S., R.5 W., on right bank 0.7 mile upstream from bridge on U. S. Highway 101, 1.1 miles upstream from mouth, and 1.2 miles north of Oceanside.

Drainage area.--559 sq mi.

Records available.--April 1912 to September 1914 (published as "near Oceanside"), January 1916, October 1929 to January 1942, October 1946 to September 1960.

Gage.--Water-stage recorder. Altitude of gage is 20 ft (from topographic map). April 1912 to September 1914, staff gage at site three-quarters of a mile upstream at different datum. January 1916, staff gage a quarter of a mile downstream at different datum.

Average discharge.--28 years (1912-14, 1929-41, 1946-60), 19.0 cfs (13,760 acre-ft per year); median of yearly mean discharges, 1.3 cfs (720 acre-ft per year).

Extremes.--1912-14, 1916, 1929-42, 1946-60: Maximum discharge, 95,600 cfs Jan. 27, 1916; no flow for several months in each year.

Remarks.--Flow regulated by Lake Henshaw. Several diversions above station. "Average discharge" represents flow to ocean during period of record, regardless of upstream development.

SAN LUIS REY RIVER BASIN

11042000 SAN LUIS REY RIVER AT OCEANSIDE, CA
(National stream-quality accounting network station)

LOCATION.--Lat 33°12'48", long 117°22'33", in SW¼SE¼SW¼ sec.14, T.11 S., R.5 W., San Diego County, Hydrologic Unit 18070303, on right bank 0.7 mi (1.1 km) upstream from bridge on Interstate Highway 5, 1.1 mi (1.8 km) upstream from mouth, and 1.2 mi (1.9 km) north of Oceanside.

DRAINAGE AREA.--558 mi² (1,450 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1912 to September 1914 (published as "near Oceanside"), January 1916, October 1929 to January 1942, October 1946 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 20 ft (6.1 m), from topographic map. April 1912 to September 1914, nonrecording gage at site 0.8 mi (1.3 km) upstream at different datum. January 1916, nonrecording gage 0.2 mi (0.3 km) downstream at different datum. Prior to Oct. 1, 1978, at datum 10.00 ft (3.048 m) lower.

REMARKS.--Records poor. No gage-height record Nov. 14 to Jan. 28, Jan. 31 to Feb. 19, and Apr. 12 to July 16. Flow regulated by Lake Henshaw, capacity, 194,300 acre-ft (240 hm³). Several diversions for irrigation and domestic use above station. AVERAGE DISCHARGE represents flow to ocean during period of record regardless of upstream development.

AVERAGE DISCHARGE.--48 years (water years 1913-14, 1930-41, 1947-80), 30.4 ft³/s (0.861 m³/s), 22,020 acre-ft/yr (27.2 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 95,600 ft³/s (2,710 m³/s) Jan. 27, 1916, from hydrograph based on discharge measurements; no flow for several months in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 25,000 ft³/s (708 m³/s) Feb. 21, gage height, 14.00 ft (4.267 m); maximum gage height, 15.83 ft (4.825 m) Jan. 29; minimum daily, 3.6 ft³/s (0.10 m³/s) Oct. 1, 12.

LOS PENASQUITOS CREEK BASIN

11023340 LOS PENASQUITOS CREEK NEAR POWAY, CA

LOCATION.--Lat 32°56'35", long 117°07'15", in Los Penasquitos Grant, San Diego County, Hydrologic Unit 18070304, on left bank 1.0 mi (1.6 km) downstream from Cypress Creek, and 5.5 mi (8.8 km) southwest of Poway.

DRAINAGE AREA.--42.1 mi² (109 km²).

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Altitude of gage is 260 ft (79.2 m), from topographic map.

REMARKS.--Records good. Flow partly regulated by several conservation reservoirs above station. Pumping from wells along stream for irrigation. Flow augmented by reclaimed water from Poway area.

AVERAGE DISCHARGE.--18 years, 7.83 ft³/s (0.222 m³/s), 5,670 acre-ft/yr (6.99 m³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,750 ft³/s (135 m³/s) Feb. 21, 1980, gage height, 10.26 ft (3.127 m) from rating curve extended above 1,400 ft³/s (39.6 m³/s); no flow at times in 1968, 1972, and 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 400 ft³/s (11.3 m³/s) and maximum (*):

Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)	Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)
Jan. 20	1445	416	11.8	4.38	1.335	Mar. 17	1915	*1,860	52.7	7.31	2.228
Feb. 10	1945	482	13.7	4.61	1.405	Apr. 1	1415	627	17.8	5.04	1.536
Mar. 14	1900	698	19.8	5.23	1.594						

Minimum daily, 0.22 ft³/s (0.006 m³/s) Oct. 20, 21.

SANTA MARGARITA RIVER BASIN

11046000 SANTA MARGARITA RIVER AT YSIDORA, CA

LOCATION.--Lat 33°18'40", long 117°20'45", in NW¼NW¼ sec.18, T.10 S., R.4 W., San Diego County, Hydrologic Unit 18070302, on Camp Joseph H. Pendleton Naval Reservation, on right bank 7.9 mi (12.7 km) upstream from mouth at Pacific Ocean at Basilone Road Bridge. Prior to Dec. 10, 1980, at site 6.2 mi (10.0 km) downstream.

DRAINAGE AREA.--740 mi² (1,917 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--February 1923 to current year. Low-flow records not equivalent prior to Dec. 10, 1980, due to installation of conservation ponds above downstream site.

GAGE.--Water-stage recorder. See WSP 1735 for history of changes prior to Nov. 27, 1935. Nov. 27, 1935, to Feb. 25, 1970, at site 5.4 mi (8.7 km) downstream at different datum. Feb. 25, 1970 to Dec. 10, 1980, at site 6.2 mi (10.0 km) downstream at different datum.

REMARKS.--Records poor. Flow partly regulated by Vail Lake since November 1948 (station 11042500). Diversions for irrigation on Rancho California (formerly Santa Margarita Ranch and Pauba Ranch).

AVERAGE DISCHARGE.--59 years, 33.9 ft³/s (0.960 m³/s), 24,560 acre-ft/yr (30.3 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 33,600 ft³/s (952 m³/s) Feb. 16, 1927, gage height, 18.00 ft (5.486 m), site and datum then in use, on basis of slope-area measurement of maximum flow; maximum gage height, 18.80 ft (5.730 m) Feb. 18, 1980, possibly affected by tide; no flow for all or part of most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,120 ft³/s (117 m³/s), Mar. 18, gage height, 7.60 ft (2.316 m); no flow many days.

SAN LUIS REY RIVER BASIN

11042000 SAN LUIS REY RIVER AT OCEANSIDE, CA
(National stream-quality accounting network station)

LOCATION.--Lat 33°12'48", long 117°22'33", in SW¼SE¼SW¼ sec.14, T.11 S., R.5 W., San Diego County, Hydrologic Unit 18070303, on right bank 0.7 mi (1.1 km) upstream from bridge on Interstate Highway 5, 1.1 mi (1.8 km) upstream from mouth, and 1.2 mi (1.9 km) north of Oceanside.

DRAINAGE AREA.--558 mi² (1,450 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1912 to September 1914 (published as "near Oceanside"), January 1916, October 1929 to January 1942, October 1946 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 20 ft (6.1 m), from topographic map. April 1912 to September 1914, nonrecording gage at site 0.8 mi (1.3 km) upstream at different datum. January 1916, nonrecording gage 0.2 mi (0.3 km) downstream at different datum. Prior to Oct. 1, 1978, at datum 10.00 ft (3.048 m) lower.

REMARKS.--Records fair. Flow regulated by Lake Henshaw, capacity, 194,300 acre-ft (240 hm³) since 1923. Several diversions for irrigation and domestic use above station. AVERAGE DISCHARGE represents flow to ocean during period of record regardless of upstream development.

AVERAGE DISCHARGE.--50 years (water years 1913-14, 1930-41, 1947-82), 31.6 ft³/s (0.895 m³/s), 22,890 acre-ft/yr (28.2 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 95,600 ft³/s (2,710 m³/s) Jan. 27, 1916, from hydrograph based on discharge measurements; no flow for several months in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,730 ft³/s (162 m³/s) Mar. 18, gage height, 10.78 ft (3.286 m); minimum daily, 4.1 ft³/s (0.116 m³/s) Aug. 7, 8.

SAN LUIS REY RIVER BASIN

11042000 SAN LUIS REY RIVER AT OCEANSIDE, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969 to current year.
CHEMICAL ANALYSES: January 1978 to September 1978.
BIOLOGICAL DATA: January 1978 to September 1978.
WATER TEMPERATURES: Water years 1971 to current year.
SEDIMENT RECORDS: Water year 1969 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1970 to current year.
SEDIMENT RECORDS: October 1968 to September 1978 (discontinued).

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS. Maximum daily mean, 5,580 mg/L Jan. 17, 1978; minimum daily, 2 mg/L on several days in 1972 and 1977.
SEDIMENT DISCHARGE: Maximum daily, 59,700 tons (54,200 metric tons) Jan. 17, 1978; minimum daily, 0.01 tons (0.01 metric tons) Nov. 4, 1969.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 5,580 mg/L Jan. 17; minimum daily, 6 mg/L Oct. 2-4.
SEDIMENT DISCHARGE: Maximum daily, 59,700 tons (54,200 metric tons) Jan. 17; minimum daily, 0.02 tons (0.02 metric tons) Oct. 1-7.

SAN LUIS REY RIVER BASIN

11042000 SAN LUIS REY RIVER AT OCEANSIDE, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969 to current year.
CHEMICAL ANALYSES: January 1978 to September 1978.
BIOLOGICAL DATA: January 1978 to September 1978.
WATER TEMPERATURES: Water years 1971 to current year.
SEDIMENT RECORDS: Water year 1969 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1970 to current year.
SEDIMENT RECORDS: October 1968 to September 1978 (discontinued).

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 5,580 mg/L Jan. 17, 1978; minimum daily, 2 mg/L on several days in 1972 and 1977.
SEDIMENT DISCHARGE: Maximum daily, 59,700 tons (54,200 metric tons) Jan. 17, 1978; minimum daily, 0.01 tons (0.01 metric tons) Nov. 4, 1969.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 5,580 mg/L Jan. 17; minimum daily, 6 mg/L Oct. 2-4.
SEDIMENT DISCHARGE: Maximum daily, 59,700 tons (54,200 metric tons) Jan. 17; minimum daily, 0.02 tons (0.02 metric tons) Oct. 1-7.

SANTA MARGARITA RIVER BASIN

11046000 SANTA MARGARITA RIVER AT YSIDORA, CA

LOCATION.—Lat 33°18'40", long 117°20'45", in NW¼NW¼ sec.18, T.10 S., R.4 W., San Diego County, Hydrologic Unit 18070302, on Camp Joseph H. Pendleton Naval Reservation, on right bank 7.9 mi (12.7 km) upstream from mouth at Pacific Ocean at Basilone Road Bridge. Prior to Dec. 10, 1980, at site 6.2 mi (10.0 km) downstream.

DRAINAGE AREA.—740 mi² (1,917 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.—February 1923 to current year. Low-flow records not equivalent prior to Dec. 10, 1980, due to installation of conservation ponds above downstream site.

GAGE.—Water-stage recorder. See WSP 1735 for history of changes prior to Nov. 27, 1935. Nov. 27, 1935, to Feb. 25, 1970, at site 5.4 mi (8.7 km) downstream at different datum. Feb. 25, 1970 to Dec. 10, 1980, at site 6.2 mi (10.0 km) downstream at different datum.

REMARKS.—Records poor. Flow partly regulated by Vail Lake since November 1948 (station 11042500). Diversions for irrigation on Rancho California (formerly Santa Margarita Ranch and Pauba Ranch).

AVERAGE DISCHARGE.—59 years, 33.9 ft³/s (0.960 m³/s), 24,560 acre-ft/yr (30.3 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.—Maximum discharge, 33,600 ft³/s (952 m³/s) Feb. 16, 1927, gage height, 18.00 ft (5.486 m), site and datum then in use, on basis of slope-area measurement of maximum flow; maximum gage height, 18.80 ft (5.730 m) Feb. 18, 1980, possibly affected by tide; no flow for all or part of most years.

EXTREMES FOR CURRENT YEAR.—Maximum discharge, 4,120 ft³/s (117 m³/s), Mar. 18, gage height, 7.60 ft (2.316 m); no flow many days.

SANTA MARGARITA RIVER BASIN

11046000 SANTA MARGARITA RIVER AT YSIDORA, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969 to September 1978 (discontinued).
WATER TEMPERATURES: Water years 1969 to September 1978.
SEDIMENT RECORDS: Water years 1969 to September 1978.

PERIOD OF DAILY RECORD.--
SEDIMENT RECORDS: October 1968 to September 1978 (discontinued).

REMARKS.--Sediment table omitted for no-flow periods October to December.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 13,000 mg/L Feb. 24, 1969; minimum daily mean, no flow for many days each year.
SEDIMENT DISCHARGE: Maximum daily, 534,000 tons (484,000 metric tons) Feb. 24, 1969; minimum daily, 0 tons on many days each year.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 6,360 mg/L Mar. 1; minimum daily mean, no flow many days during year.
SEDIMENT DISCHARGE: Maximum daily, 206,000 tons (187,000 metric tons) Mar. 1; minimum daily, 0 tons for many days during year.

SAN JUAN CREEK BASIN

11046550 SAN JUAN CREEK AT SAN JUAN CAPISTRANO, CA

LOCATION.--Lat 33°29'31", long 117°39'41", in SE¼NE¼ sec.12, T.8 S., R.8 W., Orange County, Hydrologic Unit 18070301, on left bank 300 ft (90 m) above Camino Capistrano bridge, 0.3 mi (0.5 km) upstream from Arroyo Trabuco, and 0.6 mi (1.0 km) south of San Juan Capistrano.

DRAINAGE AREA.--117 mi² (303 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1969 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 67 ft (20 m), from topographic map. Prior to Jan. 10, 1979, at datum 10.00 ft (3.048 m) higher. Prior to Aug. 29, 1979, at site 300 ft (90 m) downstream on downstream side of bridge.

REMARKS.--Records fair. No regulation above station. Capistrano Water Co. diverts 3.0 mi (4.8 km) upstream. Various amounts of diverted water reach station as irrigation return flow and rising ground water. Data for San Juan Creek near San Juan Capistrano (station 11046500) previously collected at site 2.8 mi (4.5 km) upstream was published as creek only and combined.

AVERAGE DISCHARGE.--13 years, 24.5 ft³/s (0.694 m³/s), 17,750 acre-ft/yr (21.9 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,700 ft³/s (416 m³/s), estimated, Mar. 4, 1978, gage height, 7.0 ft (2.13 m), from floodmarks, site and datum then in use; on basis of slope-conveyance study; maximum gage height, 17.8 ft (5.44 m) Feb. 18, 1980 (from floodmarks); no flow at times in some years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Feb. 25, 1969, 22,400 ft³/s (634 m³/s), at site 2.8 mi (4.5 km) upstream, as station 11046500.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 200 ft³/s (5.66 m³/s) and maximum (*):

Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)
Mar. 17	2045	1,890	53.5	13.91	4.240
Apr. 1	1430	563	15.9	12.63	3.850

Minimum daily, 0.10 ft³/s (0.003 m³/s) Sept. 4.

SAN JUAN CREEK BASIN

11046550 SAN JUAN CREEK AT SAN JUAN CAPISTRANO, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1971 to current year.
WATER TEMPERATURES: Water years 1971 to current year.
SEDIMENT RECORDS: Water years 1971 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1970 to current year.
SEDIMENT RECORDS: October 1970 to current year.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 22,000 mg/L Feb. 18, 1980; minimum daily mean, no flow for many days in 1970-72.
SEDIMENT DISCHARGE: Maximum daily, 331,000 tons (300,000 metric tons) Mar. 4, 1978; minimum daily, 0 tons (0 metric tons) on many days during most years.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 2,540 mg/L Mar. 18; minimum daily mean, 5 mg/L Mar. 15, Aug. 31, Sept. 9.
SEDIMENT DISCHARGE: Maximum daily, 7,710 tons (6,995 metric tons), Mar. 18; minimum daily, 0 tons (0 metric tons) several days during August and September.

SAN JUAN CREEK BASIN

11046550 SAN JUAN CREEK AT SAN JUAN CAPISTRANO, CA

LOCATION (REVISED).--Lat 33°29'31", long 117°39'41", in SW¼SE¼NE¼ sec.12, T.8 S., R.8 W., Orange County, Hydrologic Unit 18070301, on left bank 300 ft (90 m) above Camino Capistrano bridge, 0.3 mi (0.5 km) upstream from Arroyo Trabuco, and 0.6 mi (1.0 km) south of San Juan Capistrano.

DRAINAGE AREA.--117 mi^2 (303 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1969 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 67 ft (20 m), from topographic map. Prior to Jan. 10, 1979, at datum 10.00 ft (3.048 m) higher. Prior to Aug. 29, 1979, at site 300 ft (90 m) downstream on downstream side of bridge.

REMARKS.--Records fair. No regulation above station. Capistrano Water Co. diverts 3.0 mi (4.8 km) upstream. Various amounts of diverted water reach station as irrigation return flow and rising ground water. Data for San Juan Creek near San Juan Capistrano (station 11046500) previously collected at site 2.8 mi (4.5 km) upstream was published as creek only and combined.

AVERAGE DISCHARGE.--11 years, 27.6 ft^3/s (0.782 m^3/s), 20,000 acre-ft/yr (24.7 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,700 ft^3/s (416 m^3/s), estimated, Mar. 4, 1978, gage height, 7.0 ft (2.13 m), from floodmarks, site and datum then in use; on basis of slope-conveyance study; maximum gage height, 17.8 ft (5.44 m) Feb. 18, 1980 (from floodmarks); no flow at times in some years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Feb. 25, 1969, 22,400 ft^3/s (634 m^3/s), at site 2.8 mi (4.5 km) upstream, as station 11046500.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 200 ft^3/s (5.66 m^3/s) and maximum (*).

Gage height

SAN JUAN CREEK BASIN

465. San Juan Creek near San Juan Capistrano, Calif.

Location.--Lat 33°31'08", long 117°37'27", in NE¼NW¼ sec.32, T.7 S., R.7 W., on downstream side of right pier of bridge on State Highway 74, 2.5 miles northeast of San Juan Capistrano.

Drainage area.--110 sq mi.

Records available.--October 1928 to September 1960. Combined records of creek and diversion October 1954 to September 1960.

Gage.--Water-stage recorder. Altitude of gage is 150 ft (from topographic map). Prior to Feb. 28, 1934, at site 2½ miles downstream at different datum. Feb. 28, 1934, to Dec. 10, 1938, at present site at different datum. Dec. 11, 1938, to Dec. 17, 1941, at present site at datum 2.00 ft higher.

Average discharge.--32 years (1928-60), 12.7 cfs (9,190 acre-ft per year); median of yearly mean discharges, 2.8 cfs (2,000 acre-ft per year). Average combined discharge of creek and canal, 6 years (1954-60), 9.92 cfs (7,180 acre-ft per year).

Extremes.--1928-60: Maximum discharge, 13,000 cfs Mar. 2, 1938, by slope-area measurement, determined by Corps of Engineers; no flow at times in most years.

Remarks.--Capistrano Water Co. diverts 500 ft above station for irrigation below station. Extremes, and first two tables hereunder show flow past station only. Third table shows flow past station adjusted for diversion by Capistrano Water Co.'s canal.

SAN JUAN CREEK BASIN

470. Arroyo Trabuco near San Juan Capistrano, Calif.

Location.--Lat 33°31'36", long 117°40'08", in NE¼NE¼ sec.36, T.7 S., R.8 W., on downstream side of right pier of county road bridge (formerly U. S. Highway 101), 1.8 miles north of San Juan Capistrano.

Drainage area.--36.5 sq mi.

Records available.--October 1930 to September 1960. Prior to October 1956, published as Trabuco Creek near San Juan Capistrano.

Gage.--Water-stage recorder. Altitude of gage is 180 ft (from topographic map).

Average discharge.--30 years (1930-60), 5.04 cfs (3,650 acre-ft per year); median of yearly mean discharges, 0.5 cfs (360 acre-ft per year).

Extremes.--1930-60: Maximum discharge, 9,240 cfs Feb. 6, 1937; no flow at times in each year.

Cooperation.--Records furnished by Orange County Flood Control District.

SAN ONOFRE CREEK BASIN

462.5. San Onofre Creek at San Onofre, Calif.

Location.--Lat 33°23'00", long 117°34'22", in SW¼SE¼SE¼ sec.14, T.9 S., R.7 W., on left bank 0.2 mile north of San Onofre, 0.3 mile upstream from U. S. Highway 101, and 0.5 mile upstream from mouth.

Drainage area.--42.2 sq mi.

Records available.--October 1946 to September 1960.

Gage.--Water-stage recorder. Altitude of gage is 15 ft (from topographic map).

Average discharge.--14 years (1946-60), 1.29 cfs (934 acre-ft per year); median of yearly mean discharges, zero.

Extremes.--1946-60: Maximum discharge, 2,60[illegible] cfs Apr. 1, 1958 (gage height, 6.90 ft); no flow for most or all of each year.

Remarks.--Pumping above station for irrigation and water supply.

SAN MATEO CREEK BASIN

463.7. San Mateo Creek at San Onofre, Calif.

Location.--Lat 33°23'46", long 117°35'21", in [illegible] sec.14, T.9 S., R.7 W., on right bank 0.3 mile upstream from U. S. Highway 101, 0.8 mile upstream from mouth, 1.3 miles northwest of San Onofre, and 2.25 miles downstream from Christianitos Creek.

Drainage area.--133 sq mi.

Records available.--October 1946 to September 1960.

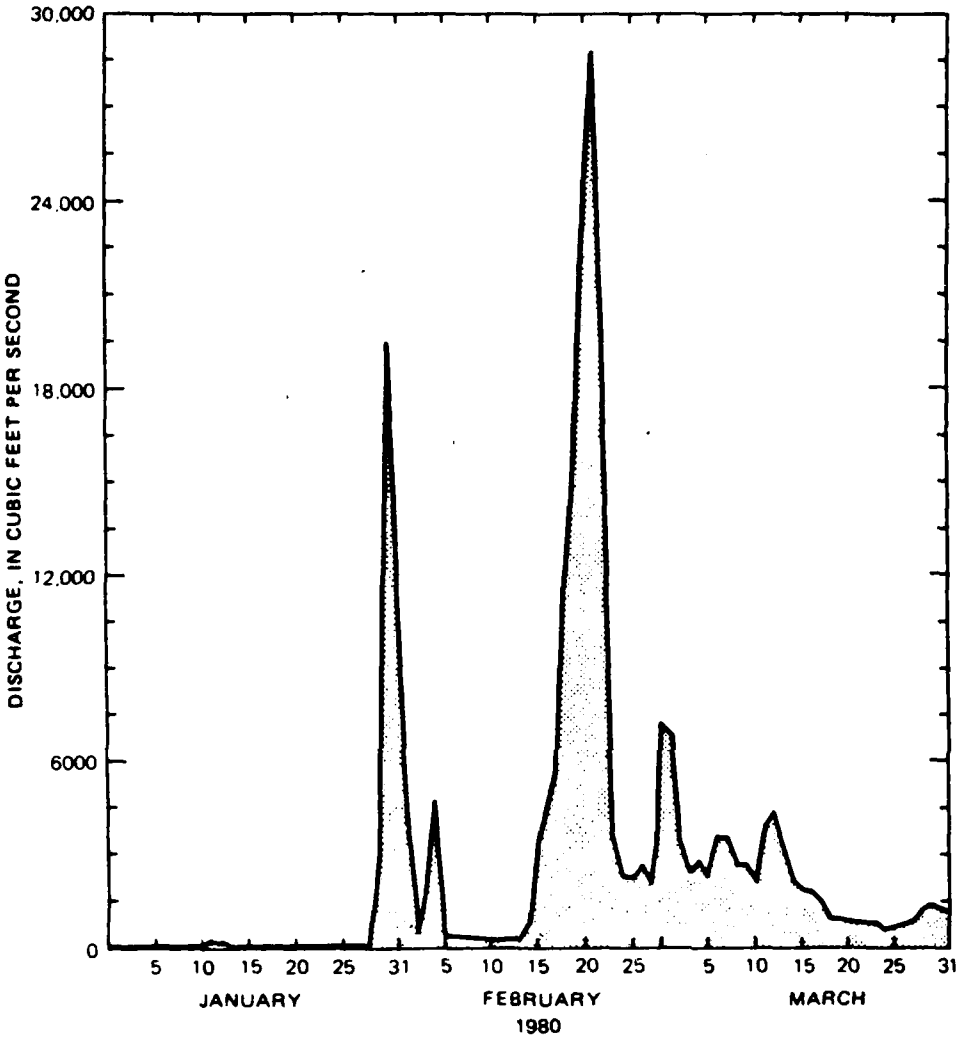
Gage.--Water-stage recorder. Altitude of gage is 20 ft (from topographic map).

Average discharge.--14 years (1946-60), 5.48 cfs (3,970 acre-ft per year); median of yearly mean discharges, zero.

Extremes.--1946-60: Maximum discharge, 4,650 cfs Apr. 1, 1958 (gage height, 5.82 ft); no flow for all or several months in each year.

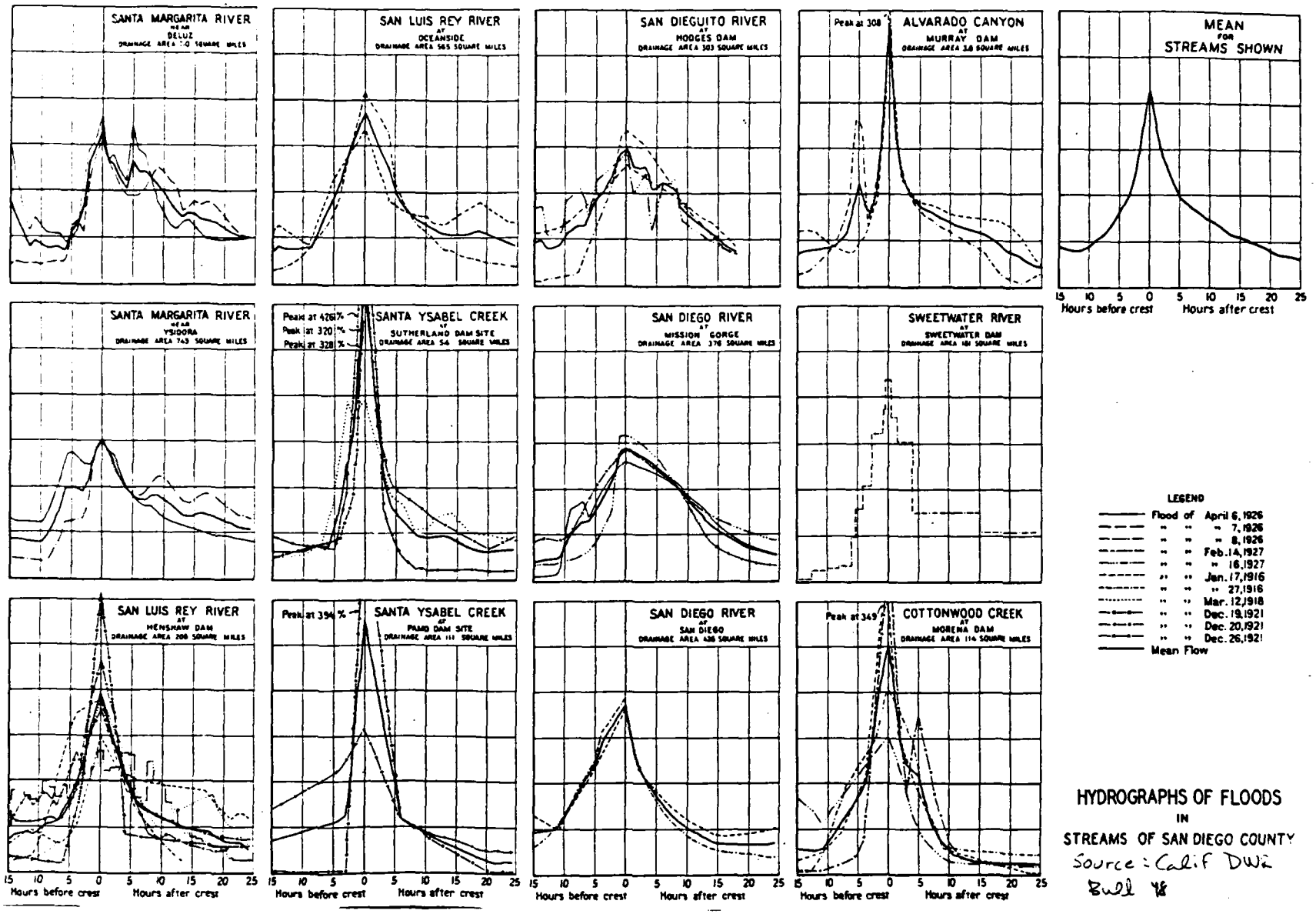
Remarks.--Minor flows regulated by percolation basins.

5. Typical hydrographs of storm events in major streams, San Diego Region



.--Daily discharge for Tijuana River near Nestor.

Source: Wahl, Crippen + Knott (1980)



HYDROGRAPHS OF FLOODS
IN
STREAMS OF SAN DIEGO COUNTY

Source: Calif DWR
Bull 48

VARIATIONS IN CREST-MEAN-DAILY-FLOW RATIOS WITH THE AREAS OF DRAINAGE BASINS AND IN DIFFERENT FLOODS

Drainage basin	Area of drainage basin, in square miles	Crest-mean-daily-flow ratio (1) of flood peak occurring on Jan. 17 1916	Jan. 27 1916	Mar. 12 1918	Dec. 19 1921	Dec. 20 1921	Dec. 26 1921	Apr. 6 1926	Apr. 7 1926	Feb. 14 1927	Feb. 16 1927	Average
Alvarado Canyon at Murray Dam	3.6	2.66	3.08									2.87
Santa Ysabel Creek at Sutherland dam site	54			1.95		3.38	4.26					3.20
Cottonwood Creek at Morena Dam	114		2.04	2.97			3.49				1.53	2.51
Santa Ysabel Creek at Pamo dam site	111					3.94	1.58					2.76
Sweetwater River at Sweetwater Dam	181		2.19									2.19
San Luis Rey River at Henshaw Dam	206	1.50	1.88	1.90	1.79	3.08	2.33				1.33	1.97
San Dieguito River at Hodges Dam	303	1.31	1.67								1.45	1.48
Temecula Creek at Nigger Canyon	321							1.75	2.07			1.91
San Diego River at Mission Gorge	376						1.42	1.29			1.58	1.43
San Diego River at San Diego	435	1.82	1.94									1.88
San Luis Rey River at Oceanside	565	1.68	2.08									1.88
Santa Margarita River at Railroad Canyon	593							1.97	2.03		1.43	1.81
Santa Margarita River at Fallbrook	645							1.37	1.86	1.67	1.36	1.56
Santa Margarita River near Deluz	710							1.79	1.54			1.66
Santa Margarita River at Ysidora	743							1.49	1.52			1.50
Average		1.79	2.13	2.27	1.79	3.47	2.62	1.61	1.80	1.67	1.45	

(1) Mean daily flow equals 1.00.

Calif DWR Bull 48

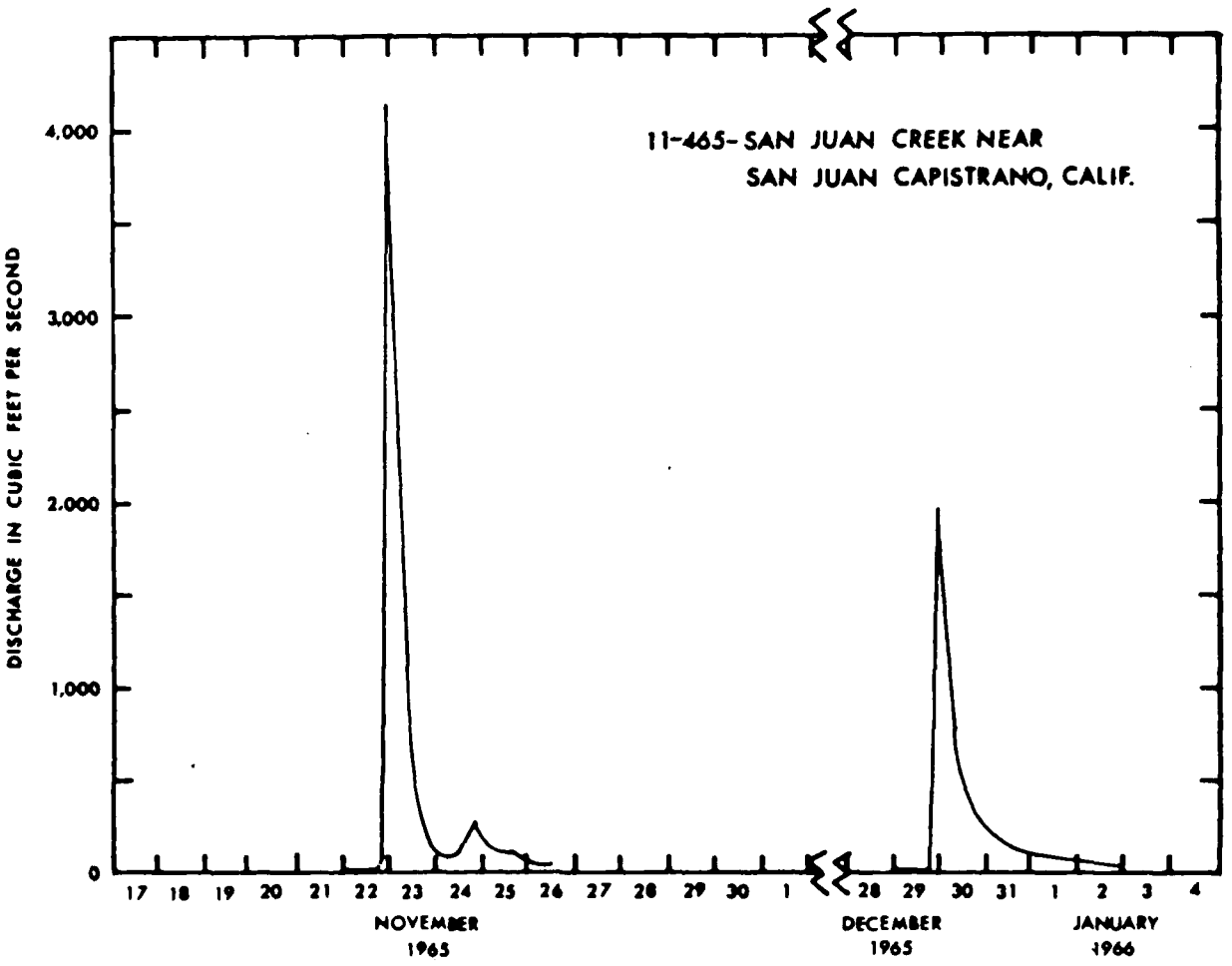
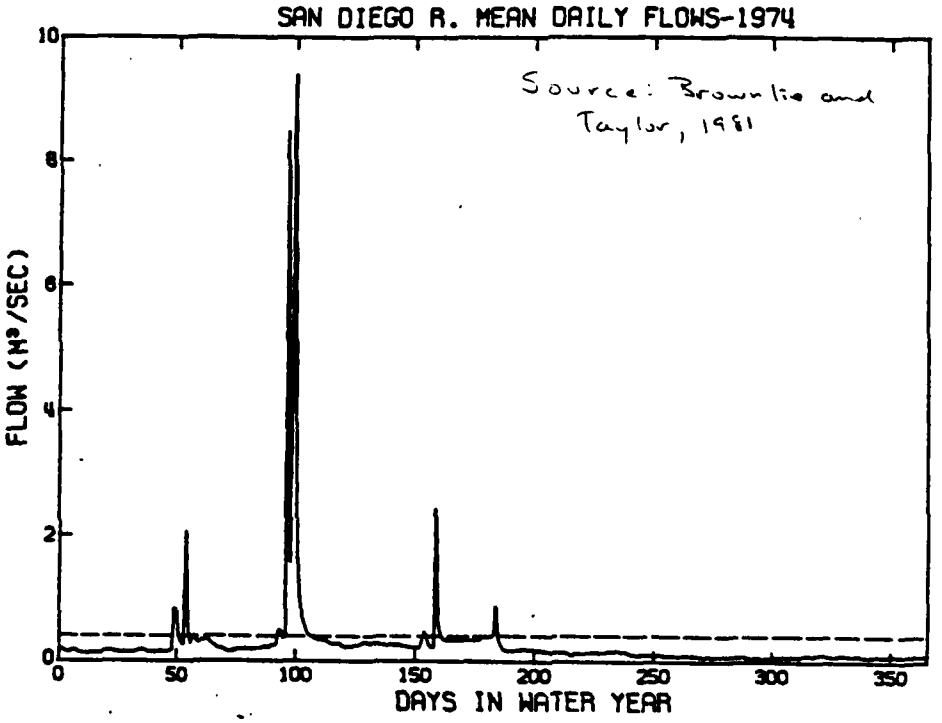


FIGURE 6.--DISCHARGE HYDROGRAPHS FOR SELECTED STREAMS IN THE COASTAL BASINS SOUTH OF THE SANTA ANA RIVER.

Source: Hedman and Pearson (1965)
USGS Water Resources Division
Open File Report, Menlo Park.



Typical annual sequence of mean daily flows (1974 water year)

6. Sediment size distributions measured in San Diego Region streams, from U.S. Geological Survey Publications and Browlie and Taylor (1981)

Santa Margarita R.

SANTA MARGARITA RIVER BASIN

11046000 SANTA MARGARITA RIVER AT TEMECULA, CALIF.—Continued 1969

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1966 TO SEPTEMBER 1969

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1966 TO SEPTEMBER 1969
(METHOD OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE; C. CHEMICALLY DISPERSED; N. IN NATIVE WATER; P. PIPET; S. SIEVE; V. VISUAL ACCUMULATION TUBE; W. IN DISTILLED WATER)

DATE	TIME	WATER TEMPERATURE (°C)	DISCHARGE (CFS)	SUSPENDED SEDIMENT CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	METHOD OF ANALYSIS
25. 1967	1400	—	17900	16100	777000	19	28	39	56	76	83	89	99	100	—	—	VPWC
28.....	1621	15	590	14300	22800	10	10	12	16	22	29	45	78	98	100	—	VPWC
5.....	1820	—	190	3440	1620	2	3	4	5	6	14	26	93	96	100	—	VPWC

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1969
(METHOD OF ANALYSIS: H. HYDROMETER; O. OPTICAL ANALYZER; S. SIEVE; V. VISUAL ACCUMULATION TUBE)

DATE	TIME	WATER TEMPERATURE (°C)	NUMBER OF SAMPLING POINTS	DISCHARGE (CFS)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED .062	.125	.250	.500	1.00	2.00	4.00	8.00	16.0	32.0	64.0	METHOD OF ANALYSIS
27. 1967	—	—	7	0	1	4	24	63	89	91	93	97	100	—	—	S
13. 1969	1200	23	2	56	2	9	62	91	98	100	—	—	—	—	—	S

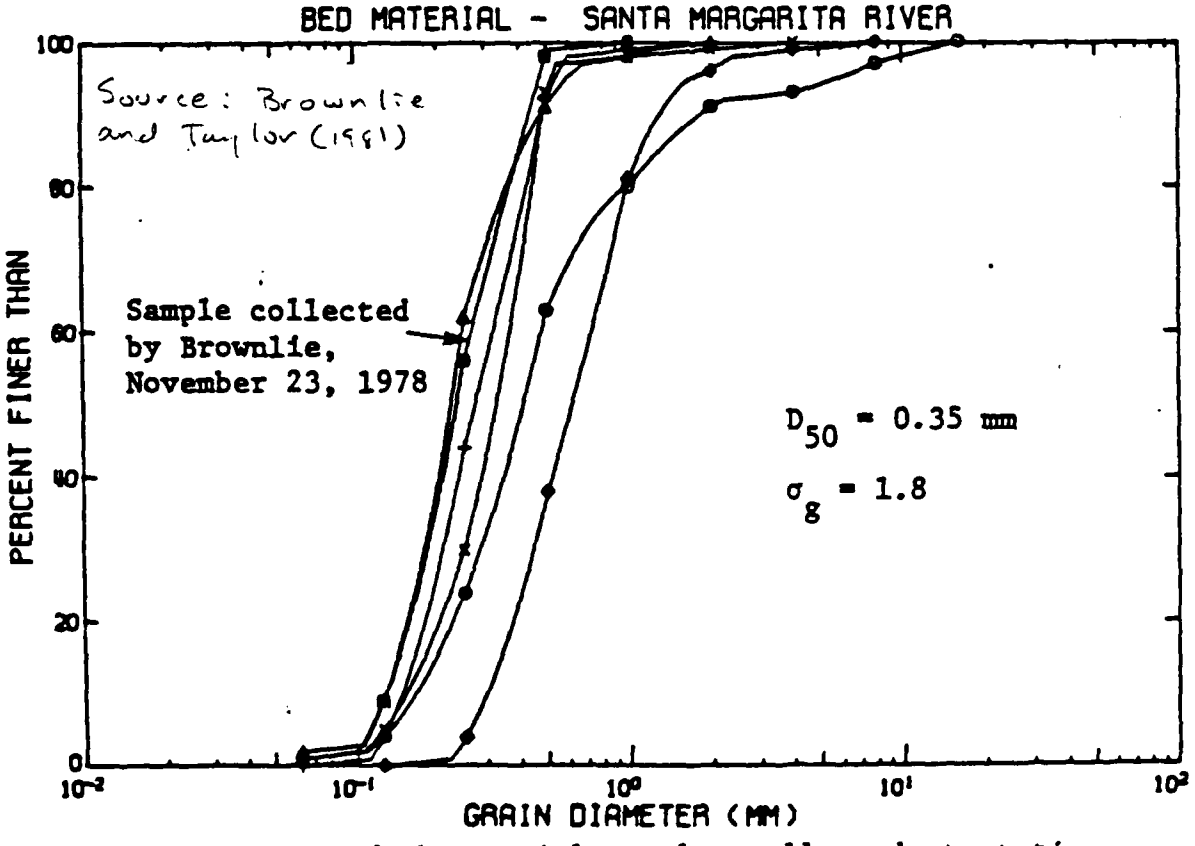


Figure C6-4 Composite bed-material samples collected at station 11046000 by the USGS between November 27, 1967, and August 16, 1973 and by Brownlie on November 23, 1978.

11042000 SAN LUIS REY RIVER AT OCEANSIDE, CA--Continued

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
OCT 17...	1400	23.0	8.4	23	.52	--	--	--
NOV 19...	1230	19.0	20	40	2.2	--	--	--
DEC 19...	0830	8.0	22	136	8.1	--	--	--
JAN 22...	1215	15.0	146	330	136	--	--	--
APR 17...	1330	26.0	427	1110	1280	11	14	17
MAY 27...	1330	28.0	342	1370	1270	6	8	10
JUN 26...	1430	28.0	272	854	627	--	--	--
JUL 23...	1100	24.5	83	329	74	--	--	--
AUG 28...	1030	23.0	347	125	117	--	--	--
SEP 16...	1015	21.0	168	69	31	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
OCT 17...	--	--	47	--	--	--	--	--
NOV 19...	--	--	25	--	--	--	--	--
DEC 19...	--	--	48	--	--	--	--	--
JAN 22...	--	--	35	44	74	96	99	100
APR 17...	28	28	48	74	93	96	100	--
MAY 27...	12	15	22	57	89	97	99	100
JUN 26...	--	--	28	--	--	--	--	--
JUL 23...	--	--	24	--	--	--	--	--
AUG 28...	--	--	92	96	97	100	--	--
SEP 16...	--	--	78	--	--	--	--	--

< Actual value is known to be less than the value shown.

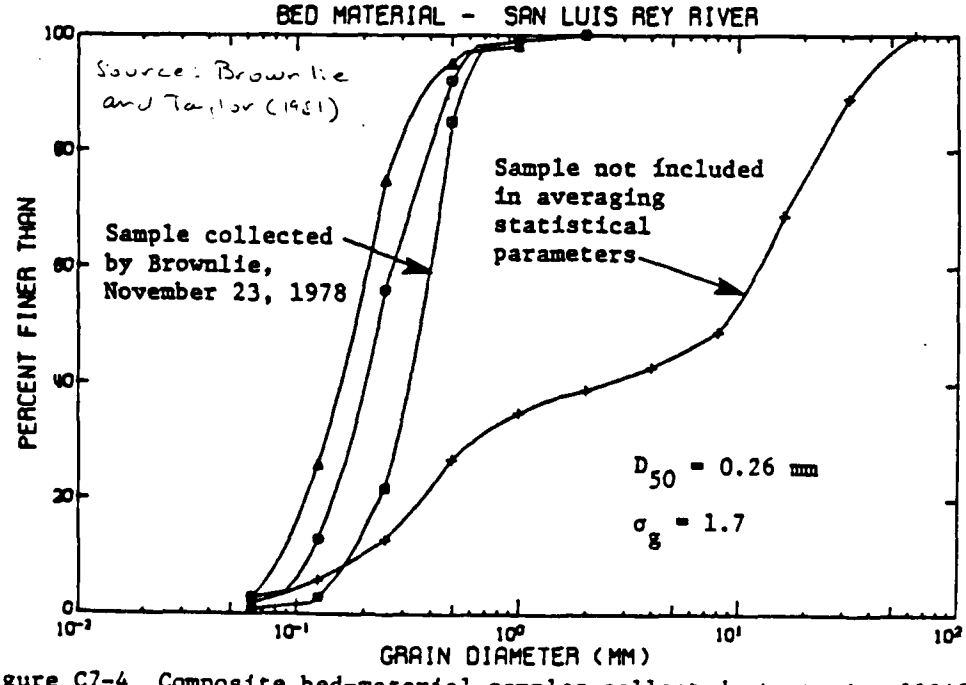


Figure C7-4 Composite bed-material samples collected at station 11042000 by the USGS between January 19, 1970 and August 16, 1973 anf by Brownlie on November 23, 1978

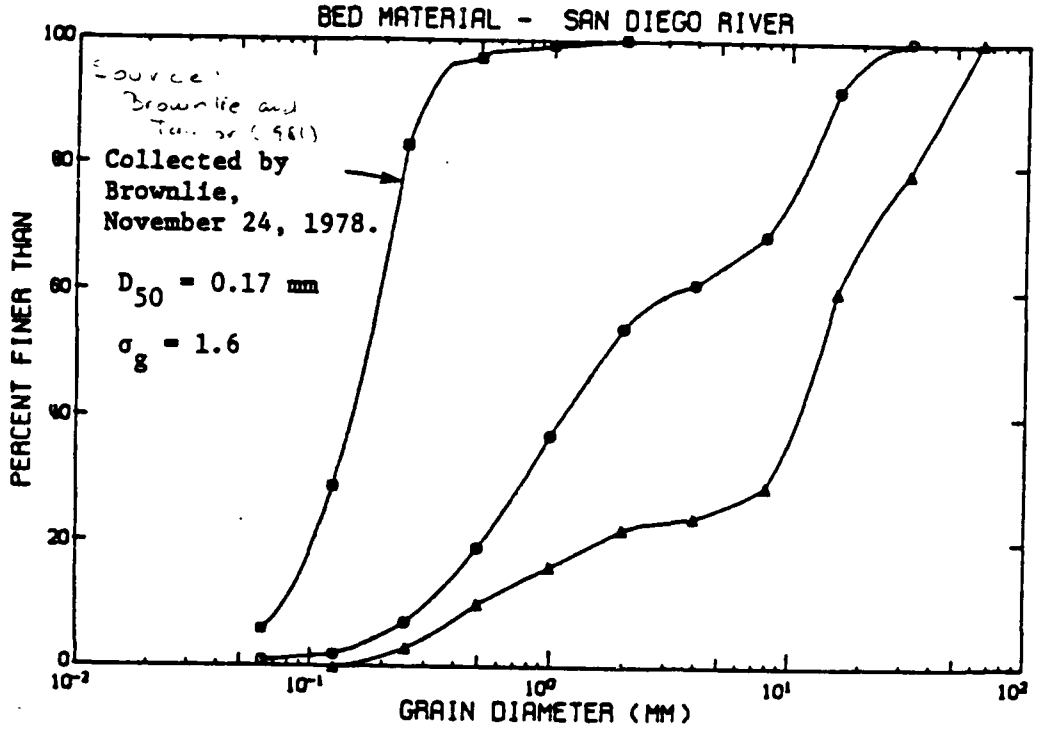


Figure C9-4 Composite surficial bed-material samples collected at 11022500 by the USGS on November 2, 1972, and August 21, 1973, and by Brownlie on November 24, 1978.

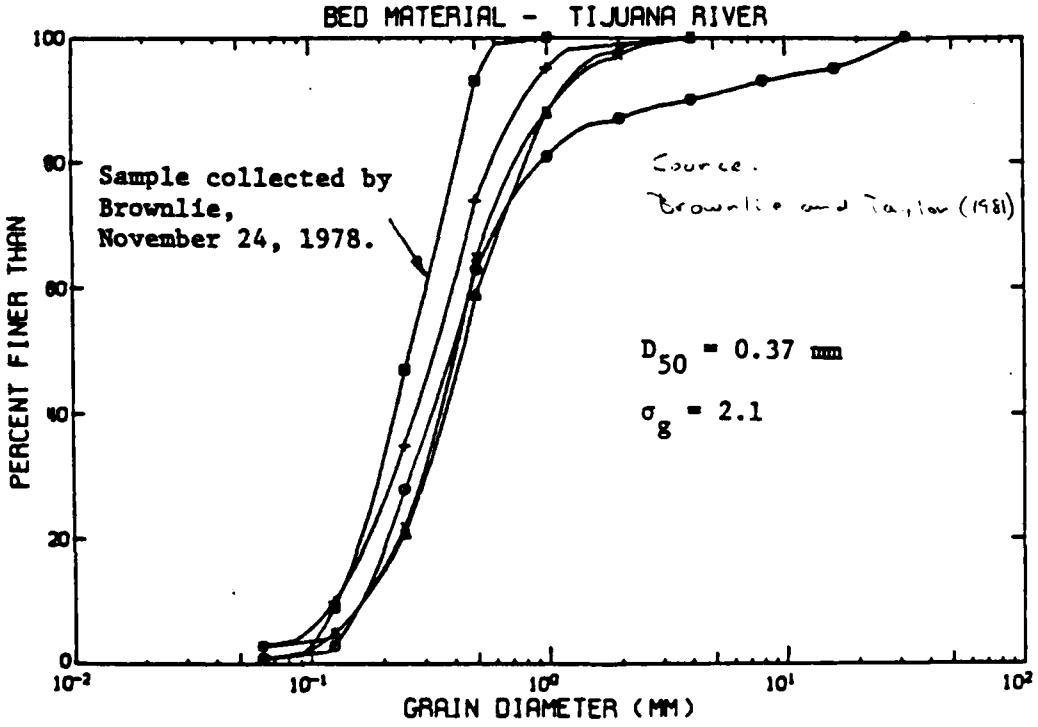


Figure C10-4 Composite bed-material samples collected at station 11013500 by the USGS betweer June 13, 1969 and August 16, 1973 and by Brownlie on November 24, 1978.

11046250 SAN ONOFRE CREEK AT SAN ONOFRE, CA

LOCATION.--Lat 33°23'00", long 117°34'22", in SE¼SE¼ sec.14, T.9 S., R.7 W., San Diego County, Hydrologic Unit 18070301, on left bank 0.2 mi (0.3 km) north of San Onofre, 0.3 mi (0.5 km) upstream from Interstate 5, and 0.5 mi (0.8 km) upstream from mouth.

DRAINAGE AREA.--42.2 mi² (106 km²).

PERIOD OF RECORD.--
SEDIMENT RECORDS: January to September 1982.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM
JAN								
20...	1700	28	13.0	2660	205	--	--	--
FEB								
11...	1055	64	15.0	749	129	47	60	75
MAR								
17...	1220	293	13.0	2350	1860	56	69	87
18...	1505	237	16.5	4190	2680	--	--	--
APR								
01...	1205	900	13.5	13200	32100	--	--	--
01...	1450	342	14.0	4050	3740	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM	TOTAL SEDIMENT LOAD T/DAY
JAN								
20...	--	--	--	--	--	--	--	205
FEB								
11...	89	91	93	96	97	100	--	132
MAR								
17...	95	100	100	100	100	--	--	1910
18...	--	23	31	52	77	92	100	3540
APR								
01...	--	63	--	--	--	--	--	33300
01...	--	53	--	--	--	--	--	4500

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	TEMPER-ATURE (DEG C)	NUMBER OF SAM-PLING POINTS	STREAM-FLOW, INSTAN-TANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
JAN							
08...	1430	13.5	4	.20	1	2	14

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
JAN							
08...	45	75	91	96	98	99	100

SAN MATEO CREEK BASIN

11046370 SAN MATEO CREEK AT SAN ONOFRE, CA

LOCATION.--Lat 33°23'28", long 117°35'23", in SE¼NW¼ sec.14 T.9 S., R.7 W., San Diego County, Hydrologic Unit 18070301, on downstream side of old U.S. Highway 101 bridge, 0.45 mi (0.7 km) upstream from mouth and 2.55 mi (4.1 km) downstream from Cristianitos Creek.

DRAINAGE AREA.--132 mi² (332 km²).

PERIOD OF RECORD.--
SEDIMENT RECORDS: January to September 1982.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM
JAN										
21...	1345	223	10.0	2030	1220	--	--	--	--	--
22...	1430	37	13.0	368	37	--	--	--	--	--
FEB										
11...	1010	265	14.0	1190	851	--	32	48	67	85
11...	1625	141	17.5	561	214	--	--	--	--	--
MAR										
17...	1005	160	13.0	2240	968	--	--	--	--	--
17...	1050	1020	13.0	9140	25200	--	--	--	--	--
17...	1130	1300	13.0	6580	23100	--	35	44	63	83
18...	1120	1640	12.5	2960	13100	--	--	--	--	--
18...	1305	1630	14.0	2730	12000	10	12	16	20	25
APR										
01...	1045	60	14.5	155	25	--	--	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	TOTAL SEDIMENT LOAD T/DAY
JAN											
21...	--	92	--	--	--	--	--	--	--	--	1270
22...	--	92	--	--	--	--	--	--	--	--	38
FEB											
11...	--	94	--	95	--	96	--	99	--	100	929
11...	--	72	--	--	--	--	--	--	--	--	235
MAR											
17...	--	95	--	--	--	--	--	--	--	--	995
17...	--	80	--	--	--	--	--	--	--	--	26600
17...	94	--	96	--	97	--	99	--	100	--	25400
18...	--	37	--	--	--	--	--	--	--	--	16800
18...	30	--	38	--	61	--	94	--	100	--	15700
APR											
01...	--	55	--	--	--	--	--	--	--	--	28

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	TEMPER-ATURE (DEG C)	NUMBER OF SAM-PLING POINTS	STREAM-FLOW, INSTAN-TANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
JAN							
15...	1100	15.5	4	1.0	1	2	7

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
JAN							
15...	30	60	76	83	89	97	100

LAS FLORES CREEK BASIN

11046100 LAS FLORES CREEK NEAR OCEANSIDE, CA

LOCATION.--Lat 33°17'36", long 117°27'06", in SE¼NW¼ sec.24, T.10 S., R.6 W., San Diego County, Hydrologic Unit 18070301, on left bank 0.8 mi (1.3 km) upstream from mouth and 8.5 mi (13.7 km) northwest of Oceanside.

DRAINAGE AREA.--26.6 mi² (66.7 km²).

PERIOD OF RECORD.--
SEDIMENT RECORDS: January to September 1982.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM
JAN									
20...	1530	15	14.0	4070	163	--	--	--	--
21...	1640	26	12.0	1600	110	52	62	70	76
FEB									
11...	1235	8.5	21.0	731	17	--	--	--	--
MAR									
17...	1410	51	14.0	4980	680	--	--	--	--
18...	1700	61	15.5	2210	362	--	--	--	--
APR									
01...	1320	145	14.5	9130	3570	--	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	TOTAL SEDIMENT LOAD T/DAY
JAN										
20...	--	96	--	--	--	--	--	--	--	252
21...	--	80	--	87	--	98	--	100	--	508
FEB										
11...	--	90	--	--	--	--	--	--	--	26
MAR										
17...	90	--	93	--	99	--	100	--	--	1040
18...	--	69	--	--	--	--	--	--	--	927
APR										
01...	76	--	84	--	96	--	99	--	100	5280

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	TEMPER-ATURE (DEG C)	NUMBER OF SAM-PLING POINTS	STREAM-FLOW, INSTAN-TANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
JAN							
08...	1200	13.0	3	.10	2	8	21

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM
JAN						
08...	45	81	96	98	98	100

LOS PENASQUITOS CREEK BASIN

11023350 LOS PENASQUITOS CREEK NEAR LA JOLLA, CA

LOCATION.--Lat 32°54'23", long 117°12'45", in SE¼SE¼ sec.32, T.14 S., R.3 W., San Diego County, Hydrologic Unit 18070304, on left bank 0.7 mi (1.1 km) east of intersection of Interstates 5 and 805 and 3.8 mi (6.1 km) northeast of La Jolla.

DRAINAGE AREA.--57.4 mi² (148.7 km²).

PERIOD OF RECORD.--
SEDIMENT RECORDS.--January to September 1982.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM
JAN								
20...	1515	172	222	103	73	86	93	97
21...	1020	279	1060	798	--	94	96	99
MAR								
15...	0840	153	1070	442	--	95	98	99
17...	1105	237	366	234	--	--	--	--
18...	1650	385	245	255	73	85	93	97

DATE	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	TOTAL SEDIMENT LOAD T/DAY
JAN								
20...	99	100	100	100	100	100	100	103
21...	99	--	100	100	100	--	--	798
MAR								
15...	99	--	100	100	--	--	--	442
17...	--	--	99	--	--	--	--	234
18...	99	--	100	--	--	--	--	255

11046550 SAN JUAN CREEK AT SAN JUAN CAPISTRANO, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1971 to current year.
WATER TEMPERATURES: Water years 1971 to current year.
SEDIMENT RECORDS: Water years 1971 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1970 to current year.
SEDIMENT RECORDS: October 1970 to current year.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 22,000 mg/L Feb. 18, 1980; minimum daily mean, no flow for many days in 1970-72.
SEDIMENT DISCHARGE: Maximum daily, 331,000 tons (300,000 metric tons) Mar. 4, 1978; minimum daily, 0 tons on many days during most years.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 22,000 mg/L Feb. 18; minimum daily mean, 4 mg/L July 10, 11, 16, 19.
SEDIMENT DISCHARGE: Maximum daily, 250,000 tons (227,000 metric tons), Feb. 18; minimum daily, 0.04 tons (0.04 metric tons) several days during November and December.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
NOV								
08...	1200	22.0	5.2	401	5.6	81	90	92
11...	1105	20.0	2.0	440	2.4	78	89	93
JAN								
17...	1335	17.0	12	281	9.1	52	63	74
FEB								
17...	1240	--	3000	7390	59900	--	15	18

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
NOV								
08...	93	93	94	95	98	100	--	--
11...	97	99	100	--	--	--	--	--
JAN								
17...	86	92	96	98	99	100	--	--
FEB								
17...	24	32	42	54	68	84	95	98

SAN DIEGUITO RIVER BASIN

11030500 SAN DIEGUITO RIVER NEAR DEL MAR, CA

LOCATION.--Lat 32°58'39", long 117°13'47", sec.7, T.14 S., R.3 W., San Diego County, Hydrologic Unit 18070304, on left bank of El Camino Real bridge 0.3 mi (0.5 km) south of intersection of El Camino Real and Via Del La Valle and 2.6 mi (4.2 km) upstream from mouth.

DRAINAGE AREA.--338 mi² (875 km²).

PERIOD OF RECORD.--
SEDIMENT RECORDS: January to September 1982.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
JAN								
07...	1430	3.7	15.0	14	.14	--	--	--
20...	1600	8.1	--	149	3.3	39	52	61
21...	1210	48	--	411	44	31	42	56
FEB								
12...	1240	23	16.5	71	4.4	--	--	--
MAR								
15...	0930	332	--	912	818	16	20	24
17...	1220	176	--	177	84	--	--	--
19...	1045	998	--	1748	4698	3	3	4

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	TOTAL SEDIMENT LOAD T/DAY
JAN								
07...	--	--	43	--	--	--	--	.30
20...	69	75	79	83	93	99	100	3.3
21...	78	82	88	95	99	100	--	49
FEB								
12...	--	--	83	--	--	--	--	25
MAR								
15...	29	33	37	47	88	100	--	1970
17...	--	--	36	46	90	99	100	153
19...	6	7	10	22	82	99	100	7830

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	TEMPER-ATURE (DEG C)	NUMBER OF SAM-PLING POINTS	STREAM-FLOW, INSTAN-TANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM
JAN											
07...	1500	15.0	4	3.7	2	9	47	86	99	100	100

APPENDIX B

SOUTH COAST REGION

CONTENTS

1. Pertinent stream gages in the South Coast Region

REGION:
SOUTH COAST

STREAMS:
ALISO CREEK, LAGUNA CANYON, SAN DIEGO CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
X1-3100	11-0475.00	AILSO CR.	OCEMA	33-37-34 117-41-03	R	1930	PRESENT		8.1	
Y1-4810		LAGUNA CYN.	OCEMA	33-33-06 117-46-36	R	1971			8.3	
Y1-3200	11-0485.00	SAN DIEGO CR. NEAR IRVINE	USGS	33-40-20 117-47-10	R	1949			40.3	
Y1-3100	11-0485.55	SAN DIEGO CR. AT CAMPUS DR.	USGS	33-39-20 117-50-38	R	1977	PRESENT		105.0	
Y1-3050		SAN DIEGO CR. AT JAMBOREE	OCEMA	33-39-03 117-51-56	R	1973	1977		121.0	
Y1-2200	11-0480.00	PETERS CYN WA	OCEMA	33-40-30 117-50-06	R	1930	1963		86.0	

R = RECORDING

F = DAILY FLOW

REGION:
SOUTH COAST

STREAMS:
SANTA ANA RIVER, SANTIAGO CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi^2	REMARKS
Y1-1100	11_0780.00	SANTA ANA R. AT SANTA ANA	USGS	33_44_56 117-54_30	R	1923	PRESENT		1700.0	
Y1-1200	11_0757.60	SANTA ANA R. NR. KATELLA AVE AT ORAN	USGS	33-48-08 117-52-39	R	1973	1976		1593.0	
Y1-1175	11-0775.00	SANTIAGO CR. AT SANTA ANA	USGS	33-46-13 117-53-02	R	1928	PRESENT		98.4	COMBINE w/ Y1200, Y1210
Y1-1245	11-0770.00	SANTIAGO CR. AT VILLA PARK	OCEMA	33_49_06 117-46-36	R	1920	1963		84.0	COMBINE (BACKUPS)
Y1-1257		SAME AS ABOVE	USGS	33-48_58 117-45_55	R	1963	PRESENT		83.0	
Y1-1210	11-0757.55	SANTA ANA R. AT BALL	USGS	33-49_00 117-52_17	R	1976	PRESENT		1586.0	
Y1-1363	11-0756.00	SANTA ANA R. AT IMPERIAL	OCEMA	33_51-23 117-47-23	R	1934	PRESENT		1542.0	

R = RECORDING

F = DAILY FLOW

REGION:
SOUTH COAST

STREAMS:
WESTMINSTER CH., LOS CERRITOS CH., GARDEN GROVE/E. WINTERSBERG
SAN GABRIEL RIVER, CARBON/COYOTE CREEKS

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA M_i^2	REMARKS
Y1-4170		WESTMINSTER CH. AT BEACH BLVD.	OCEMA	33-45-07 117-59-26	R	1955	PRESENT		6.7	
Y1-4205		GARDEN GROVE, E. WINTERSBERG AT GOTHARD	OCEMA	33-42-58 117-59-57	R	1967	PRESENT		20.8	
Z8-1910	11-0917.50	LOS CERRITOS CH. ANA ST. NEAR LONG BEACH	LAC	33.47-24 118-06-06	R	1949	1955		36.2	
Z8-1915	11-0917.40	LOS CERRITOS CH. STEARN ST. NEAR LONG B.	LAC	33-47-42 118-06-12	R	1955	PRESENT		36.2	
Z8-1620	11-0880.00	SAN GABRIEL R. AT SP ST. NR. LOS ALAM.	LAC	33-48-43 118-05-24	R	1928	PRESENT		471.0	COMBINE W/ COYOTE CR.
Z8-1170	11-0907.00	COYOTE CR. AT LOS ALAMITOS	LAC	33-48-38 118-04-28	R	1963	PRESENT		150.0	COMBINE W/ SAN GABRIEL RIVER
Z8-1200	11-0905.50	COYOTE CR. CENTRALIA RD. NEAR ARTESIA	LAC	33-50-24 118-03-36	R	1928	1930		110.0	
Z8-1265	11-0905.00	COYOTE CR. NR. ARTESIA	LAC	33-50-18 118-03-36	R	1930	1963		121.0	

R= RECORDING
F= DAILY FLOW

REGION:
SOUTH COAST

STREAMS:
LOS ANGELES RIVER

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA MI²	REMARKS
Z6_1100	11_1030.00	LOS ANGELES RIVER	LAC	33_49_02 118-12-20	R	1928	PRESENT		829	
Z6_1140		LOS ANGELES AT BEL HART	LAC	33_49_06 118-12-18	R	1955	PRESENT		840	
Z6_3100	11_1031.00	DOMINGUEZ CH. ROSE CR. BLVD. NEAR TORRANCE	LAC	33_54_06 118-19-12	R	1942	1955			
Z6_3150	11_1031.40	DOMINGUEZ CH HARBOR BLVD. NEAR TORRANCE	LAC	33_51_18 118-16-42	R	1942	PRESENT			
Z6-3310	11_1031.60	DOMINGUEZ CH. AT CARS ST. NEAR WILMINGTON	LAC	33-49_54 118_15-24	R	1938	PRESENT		56	

R=RECORDING

F= DAILY FLOW

REGION:
SOUTH COAST

STREAMS:
BALLONA CREEK, RUSTIC CANYON, SANTA MONICA CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA Mi²	REMARKS
Z5-3100	11-1036.20	BALLONA CR. PACIFIC	LAC	33-57-48 118-27-12	R	1940	1962			
Z5-3250	11-1035.10	BALLONA CR. CENT BLVD.	LAC	33-59-00 118-24-48	R	1928	1936			
Z5-3300	11-1035.00	BALLONA CR. NEAR CULVER CITY	LAC	33-59-54 118-24-05	R	1928	PRESENT		34.5	COMBINE
Z5-3920	11-1035.30	SAWTELLE-WESTWOOD	LAC	33-59-54 118-24-54	R	1951	PRESENT		23.0	COMBINE
Z5-3360	11-1035.20	SEPULVEDA CR.	LAC	34-00-48 118-25-30	R	1932	1950		25.7	
Z5-6050	11-1038.45	SANTA MONICA C. RUSTIC CYN.	LAC	34-01-42 118-31-00	R	1931	PRESENT			
Z5-6055	11-1038.32	RUSTIC CYN. AB S.M.	LAC	34-01-48 118-30-54	R	1956	PRESENT			
Z5-6100	11-1037.90	SANTA MONICA C. AB RUST.	LAC	34-01-48 118-30-54	R	1940	PRESENT			
Z5-6905	11-1038.20	RUSTIC CYN. STD DR AB CH RD SANTA MONICA	LAC	34-01-48 118-30-54	R	1934	1941			

R= RECORDING

F= DAILY FLOW

REGION:
SOUTH COAST

STREAMS:
TOPANGA CREEK, MALIBU CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
Z5_2150	11_1040.00	TOPANGA CR. NEAR TOPANGA BEACH	LAC	34_03_52 118_35_10	R	1930	PRESENT		18.0	
Z5_1300	11_1050.00	MALIBU CREEK NEAR CALABASA	LAC	34_04_54 118_42_06	F	1903	1906		94.2	
Z5_1140	11_1055.00	MALIBU CR. AT CRATER CP NEAR CALABASA	LAC	34_04_40 118_42_03	R	1931	PRESENT		105.0	
Z5_1200	11_1054.00	COLD CREEK AT CRATER CP	LAC	34_04_42 118_41_54	R	1931	PRESENT			

R = RECORDING

F = DAILY FLOW

REGION:
SOUTH COAST

STREAMS:
ARROYO SEQUIT, SYCAMORE CANYON

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA Mi^2	REMARKS
Z5-7750	11-1056.50	ARROYO SEQUIT MULHLD CR.	LAC	34-02-42 118-56-00	R	1953	PRESENT			
Z5-7790	11-1056.50	SYCAMORE CYN. C, L, A. HWY. 101 ALT.	LAC	34-03-18 118-57-48	R	1969	PRESENT		4.9	
Z5-7800	11-1057.00	SYCAMORE CYN. C, L, NEAR NEWBERRY	LAC	34-05-30 118-56-54	R	1960	1973		1.3	

R= RECORDING

F= DAILY FLOW

2. Stream gages in Orange County, with location map from the Orange County Environmental Management Agency (OCEMA)

ORANGE COUNTY ENVIRONMENTAL MANAGEMENT AGENCY

ACTIVE STREAM-GAGING STATIONS

OCEMA DISCHARGE SUMMARY

OCEMA NUMBER	STATION NAME	MOMENTARY PEAK		MAXIMUM DAY	MINIMUM DAY	MEAN DAILY	TOTAL VOLUME
		L/S	DATE	L/S	L/S	L/S	DAM³
2	Fullerton Creek at Richman Avenue, Fullerton	78100	03-01-83	22900	5	403	12560
4	Aliso Creek near Jeronimo Road, El Toro	47300	02-27-83	4390	0	118	3670
5	Arroyo Trabuco at Camino Capistrano	69100	02-27-83	12600	0	698	21900
122	Santa Ana River at Imperial Highway	248000	03-01-83	15800	550	16100	507000
152	Alameda Storm Channel, Orange	42200	03-01-83	7730	0	-	-
207	Westminster Channel at Beach Blvd.	41900	03-01-83	7900	0	-	-
211	Brea Creek at Darlington Avenue, Buena Park	50300	03-01-83	16700	17	162	12100
213	Carbon Canyon Diversion Channel, Anaheim	-	-	-	0	-	-
214	Santiago Creek at Villa Park Dam	34000	03-03-83	22700	0	860	27300
216	El Modena - Irvine Channel at Myford Road	142000	03-01-83	22900	17	281	8870
217	East Garden Grove - Wintersburg Channel, Huntington Beach	34000	03-01-83	24200	8	430	13500
218	Oso Creek at Crown Valley Parkway, Mission Viejo	139000	02-27-83	17400	12	367	11500
220	Santa Ana - Delhi Channel at Irvine Avenue	123000	03-01-83	39300	16	467	16300
222	Laguna Canyon Channel at Woodland Drive	39600	03-01-83	3820	5	89	2800

USGS HISTORICAL DISCHARGE SUMMARY

STATIONS IN OR AFFECTING ORANGE COUNTY

STATION NAME	DRAINAGE AREA	PERIOD OF RECORD		HISTORICAL DATA					
				MOMENTARY PEAK		TOTAL RUNOFF IN DAM³			
	Km²	FROM	TO	L/S	DATE	MAXIMUM	YEAR	MINIMUM	YEAR
Brea creek below Brea Dam	55.9	1941	*	48100	02-18-80	18700	1980	1	1951
Carbon Creek below Carbon Dam	50.5	1961	*	12600	02-25-69	32900	1962	3	1972
Fullerton Creek below Fullerton Dam	12.8	1941	*	8860	01-25-69	3610	1980	0	1951
San Diego Creek near Irvine	104	1949	*	218000	02-16-80	31300	1980	0	1951
San Juan Creek at San Juan Capistrano	303	1969	*	634000	02-25-69	132000	1980	533	1972
San Juan Creek at San Juan Capistrano	274	1928	1968	368000	03-02-38	61700	1941	0	1951
Santa Ana River below Prado Dam	3860	1940	*	211000	02-21-80	151000	1980	34700	1961
Prior to Prado Dam Construction	3860	1930	1939	2830000	03-02-38	14700	1938	16100	1939
Santa Ana River at Santa Ana	4400**	1923	*	#131000	03-02-38	500000	1980	108	1951
Santiago Creek at Modjeska	32.4	1961	*	184000	03-02-38	47000	1969	193	1963
Santiago Creek at Santa Ana	246	1928	*	187000	02-25-69	64000	1969	30	1961

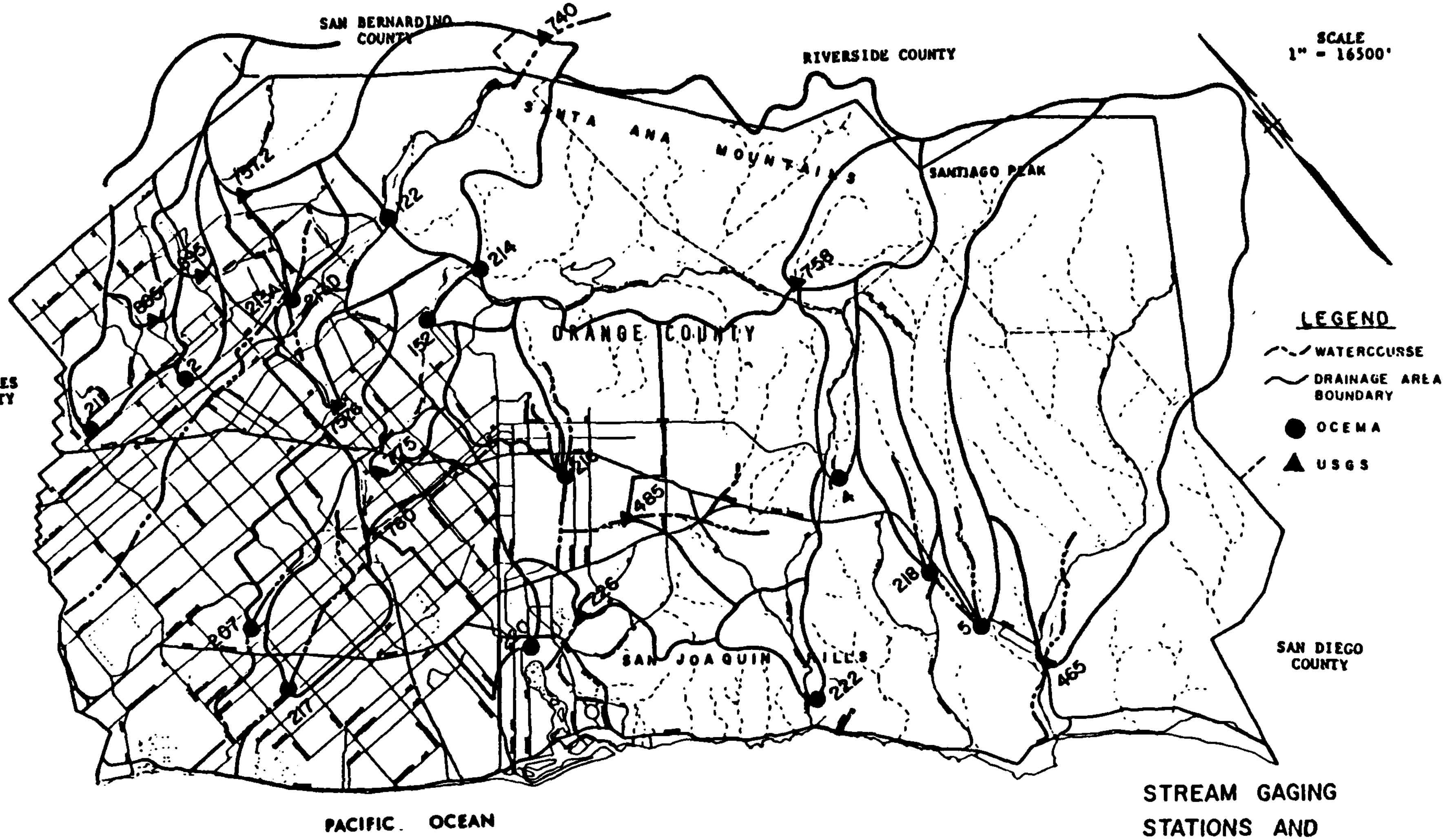
* Station currently collecting data

** Excludes 2,000 km² above Lake Elsinore

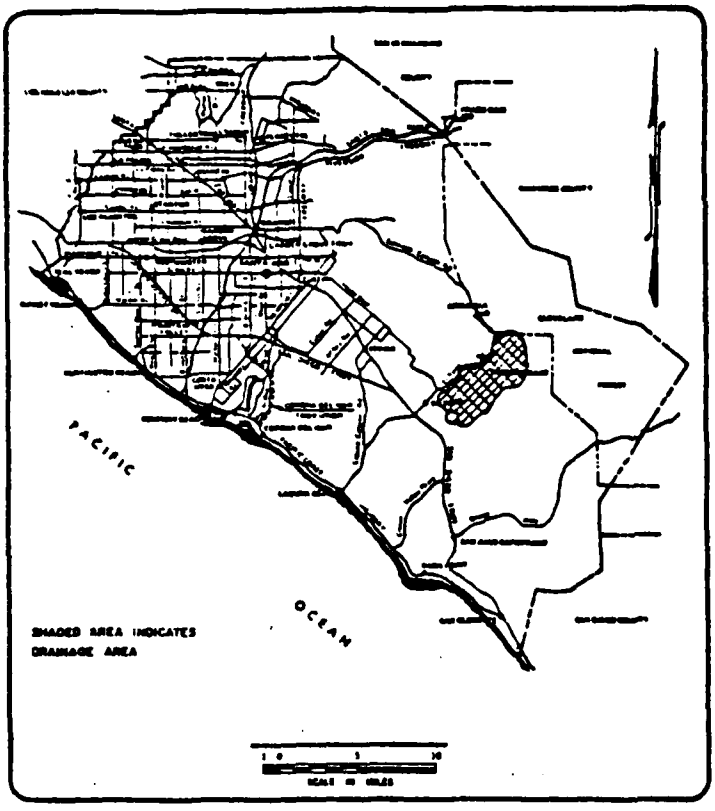
\# Approximately 1.7 million L/S is not included because it broke out at the river channel upstream at the gaging station

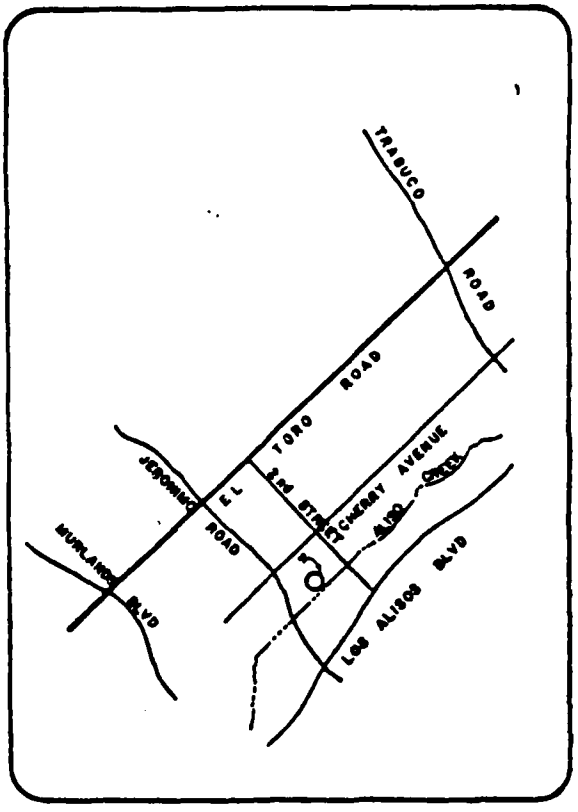
L/S = Liters per Second

ORANGE COUNTY ENVIRONMENTAL MANAGEMENT AGENCY



STREAM GAGING
STATIONS AND
TRIBUTARY AREAS





STATION NO. 4
ALISO CREEK NEAR JERONIMO ROAD, EL TORO

LOCATION: LATITUDE 33°37'30", LONGITUDE 117°41'07". ON THE NORTH SIDE OF THE IMPROVED CONCRETE CHANNEL 91m (300ft) UPSTREAM OF JERONIMO ROAD.

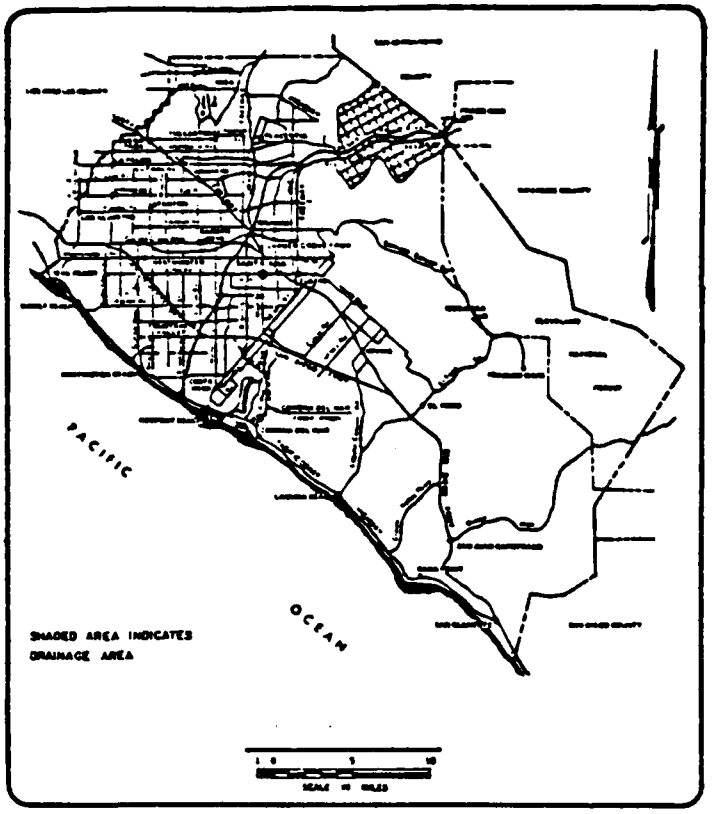
DRAINAGE AREA: $21 \times 10^6 m^2$ (8.1 sq mi).

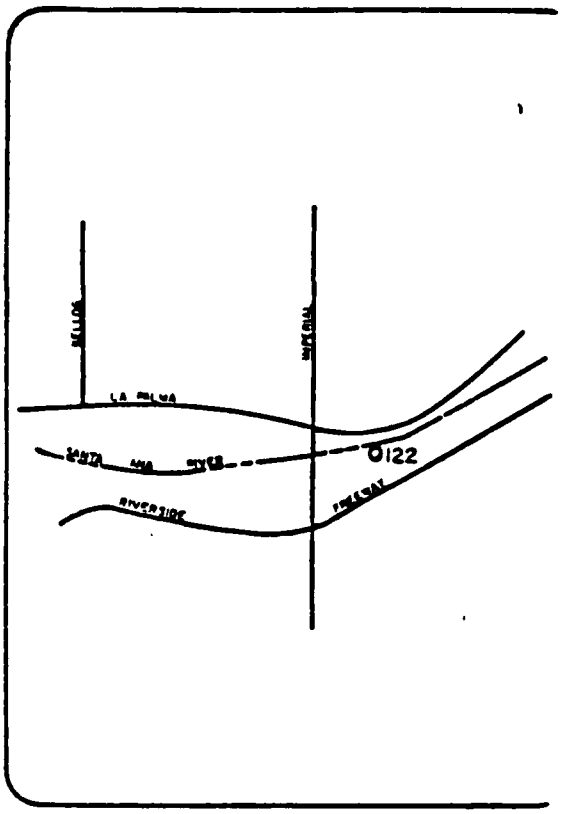
GAGE: WATER-STAGE RECORDER. GAGE ELEVATION 131 m (430 ft) MSL.

CHANNEL: CONCRETE LINED.

PERIOD OF RECORD: OCTOBER 1930 TO PRESENT.

REMARKS: SEVERAL SMALL CONSERVATION RESERVOIRS IN WATERSHED ABOVE GAGE. NORMAL FLOW AFFECTED BY RETURN FLOW FROM IRRIGATED AREAS AND DISCHARGE FROM LOCAL WATER SUPPLY RESERVOIR.





STATION NO. 122
SANTA ANA RIVER AT IMPERIAL HIGHWAY

LOCATION: LATITUDE 33° 52' 32", LONGITUDE 117° 47' 17" APPROXIMATELY 183.8 m (600 ft.) UPSTREAM OF IMPERIAL HIGHWAY BRIDGE.

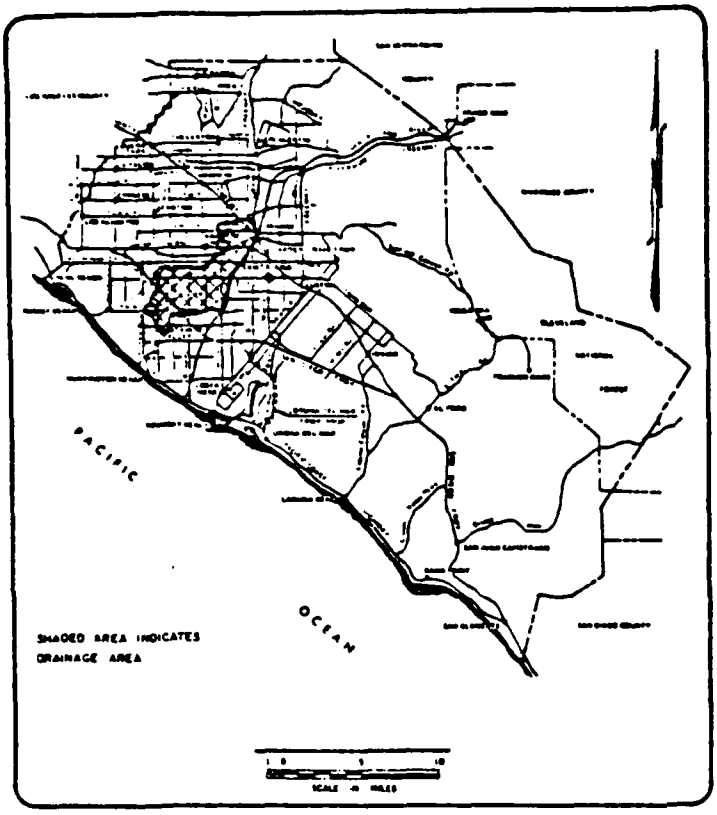
DRAINAGE AREA: 3977 X 10^6 m^2 (1536 sq. mi).

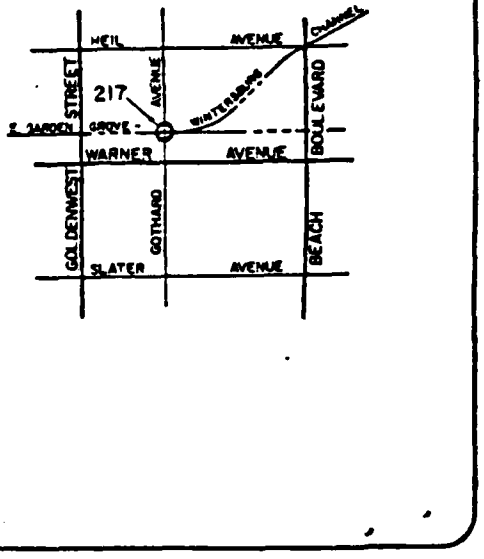
GAGE: FLOAT OPERATED WATER-STAGE RECORDER. GAGE ELEVATION 86.6 m (284 ft).

CHANNEL: TRAPEZOIDAL EARTHEN WITH ROCK LINED BANKS.

PERIOD OF RECORD: DECEMBER 1934 TO PRESENT. SEVERAL YEARS MISSING.

REMARKS: FLOW REGULATED BY PRADO DAM. NATURAL FLOW AFFECTED BY GROUND WATER WITHDRAWAL, IRRIGATION AND INDUSTRIAL RETURN, AND LARGE QUANITIES OF IMPORTED WATER.





STATION NO. 217
EAST GARDEN GROVE – WINTERSBURG CHANNEL, HUNTINGTON BEACH

LOCATION: LATITUDE 33°42'58", LONGITUDE 117°59'57", APPROXIMATELY 200m (650ft) NORTH OF THE INTERSECTION OF GOTHARD STREET AND WARNER AVENUE.

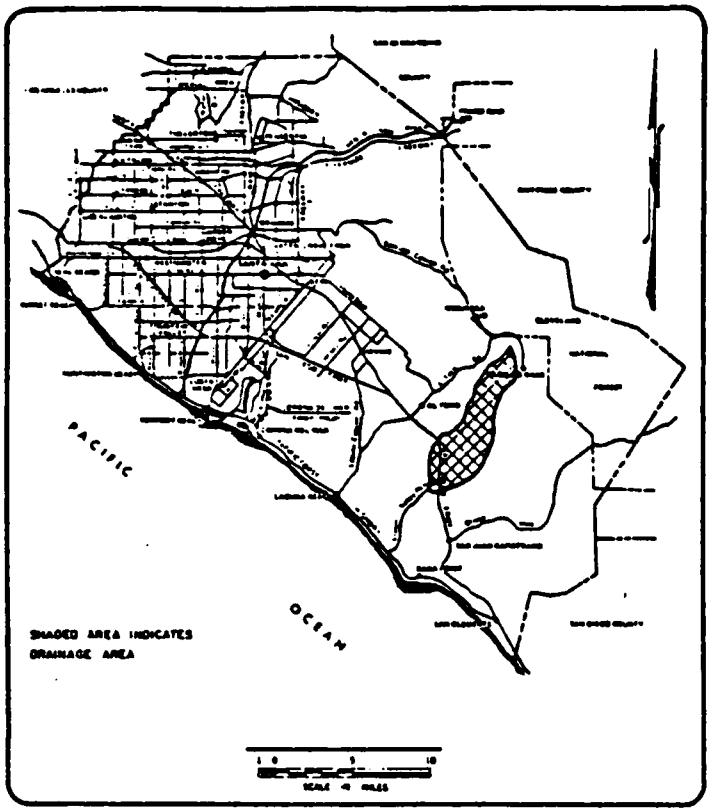
DRAINAGE AREA: $53.8 \times 10^6 m^2$ (20.8 SQUARE MILES) INCLUDING $7.2 \times 10^6 m^2$ (2.8 SQUARE MILES) ABOVE HASTER RETARDING BASIN.

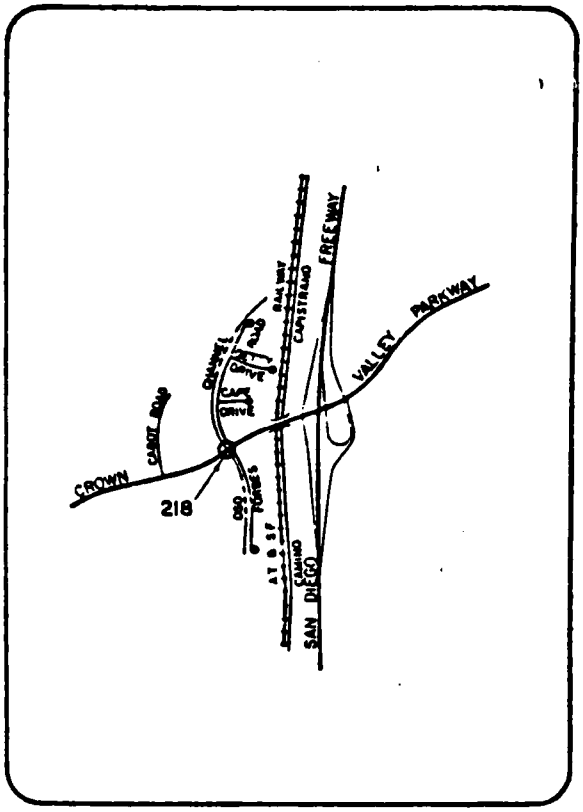
GAGE: WATER-STAGE RECORDER. GAGE ELEVATION 7.6m (25ft) MSL.

CHANNEL: TRAPEZOIDAL EARTEN.

PERIOD OF RECORD: DECEMBER 1967 TO PRESENT.

REMARKS: FLOW AFFECTED BY RETARDING BASIN APPROXIMATELY 1.27×10^4 m. (7.5 MILES) UPSTREAM.





STATION NO. 218
OSO CREEK, MISSION VIEJO

LOCATION: LATITUDE 33°33'29", LONGITUDE 117°40'33", APPROXIMATELY 370m (1200ft) WEST OF THE INTERSECTION OF CROWN VALLEY PARKWAY AND SAN DIEGO FREEWAY.

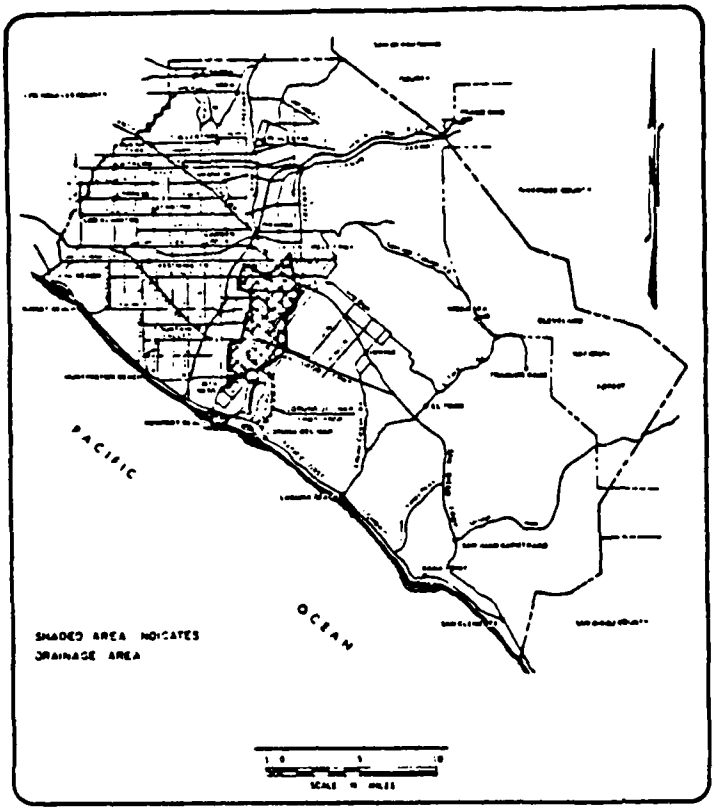
DRAINAGE AREA: $36.2 \times 10^6 m^2$ (14 SQUARE MILES).

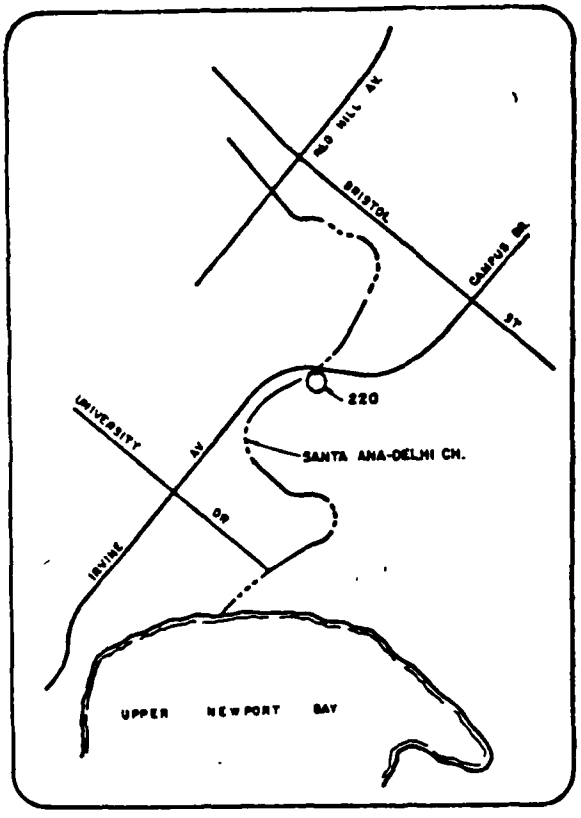
GAGE: WATER-STAGE RECORDER. GAGE ELEVATION 75m (250ft) MSL.

CHANNEL: CONCRETE LINED TRAPEZOIDAL.

PERIOD OF RECORD: DECEMBER 1969 TO PRESENT.

REMARKS: NO REGULATION OR DIVERSION ABOVE GAGE.





STATION NO. 220
SANTA ANA-DELHI CHANNEL AT IRVINE AVENUE, COSTA MESA

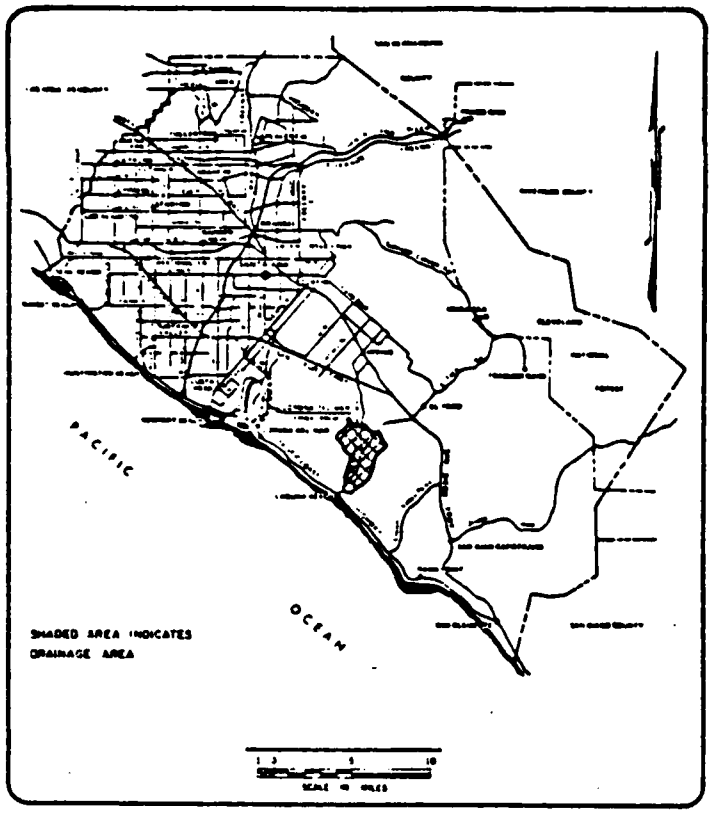
LOCATION: LATITUDE 33°39'36", LONGITUDE 117°52'49", ON THE SOUTHWEST (DOWNSTREAM) SIDE OF THE IRVINE AVENUE BRIDGE.

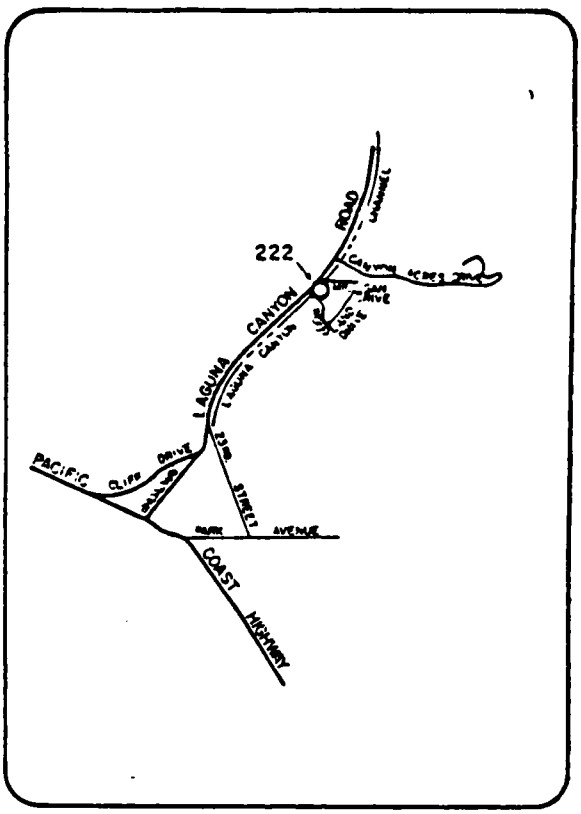
DRAINAGE AREA: $4.56 \times 10^7 m^2$ (17.6 SQUARE MILES).

GAGE: WATER-STAGE RECORDER. DATUM OF GAGE IS 1.8 METERS (6 FEET) ABOVE MEAN SEA LEVEL.

CHANNEL: TRAPEZOIDAL EARTHEN.

REMARKS: NO REGULATIONS OR DIVERSION ABOVE GAGE.
ADDITIONAL RECORDS AVAILABLE FOR LOCATION 1900 METERS (1.2 MILES) UPSTREAM FROM OCTOBER 1949 TO JUNE 1961.





STATION NO. 222
LAGUNA CANYON CHANNEL, LAGUNA BEACH

LOCATION: LATITUDE 33°33'05", LONGITUDE 117°48'00", ON THE SOUTH SIDE OF LAGUNA CANYON CHANNEL 7.6m (25ft) UPSTREAM OF WOODLAND DRIVE BRIDGE.

DRAINAGE AREA: $21.4 \times 10^6 m^2$ (8.3 SQUARE MILES).

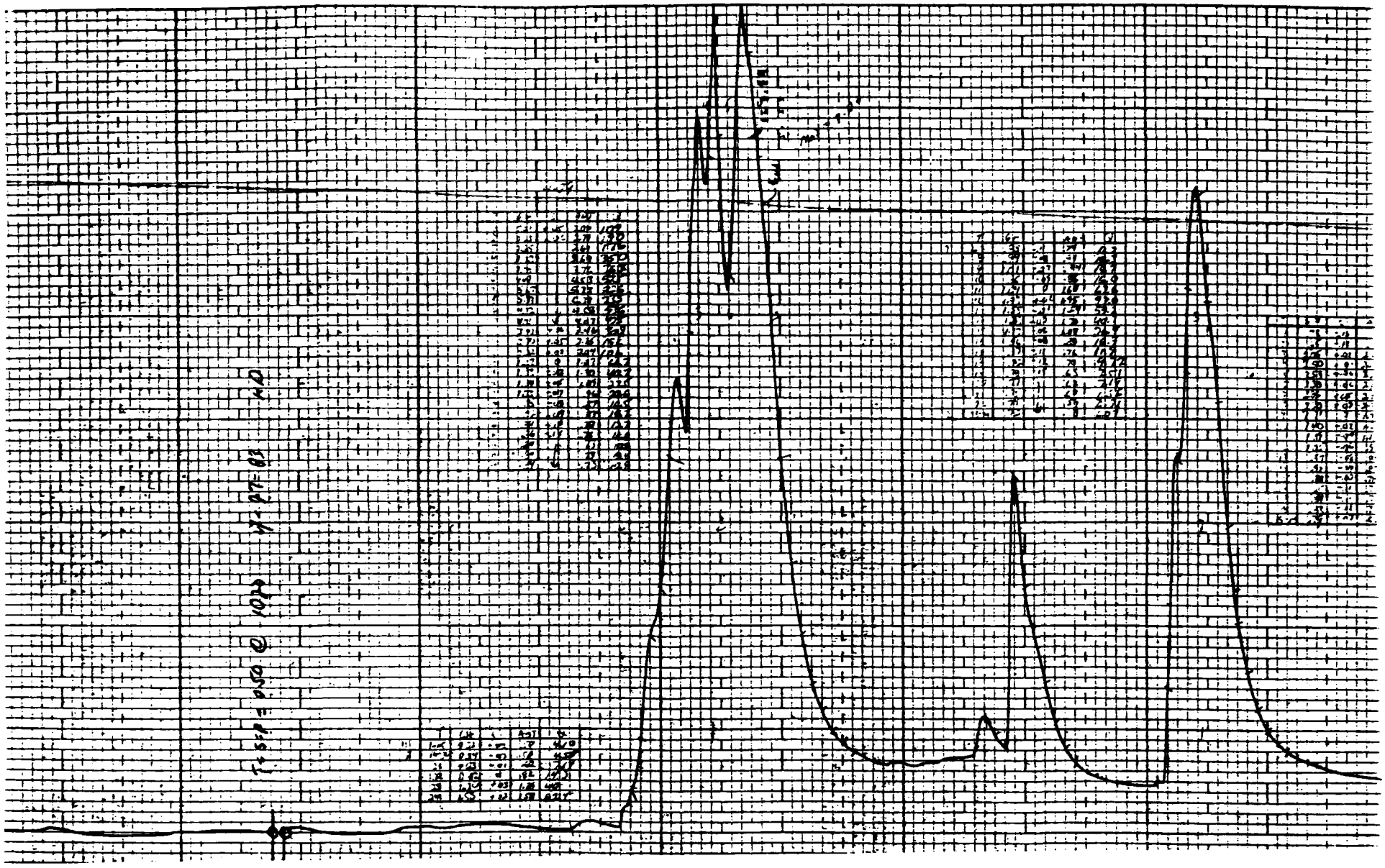
GAGE: WATER-STAGE RECORDER. GAGE ELEVATION 20.4m (67ft) (FROM CHANNEL PLANS).

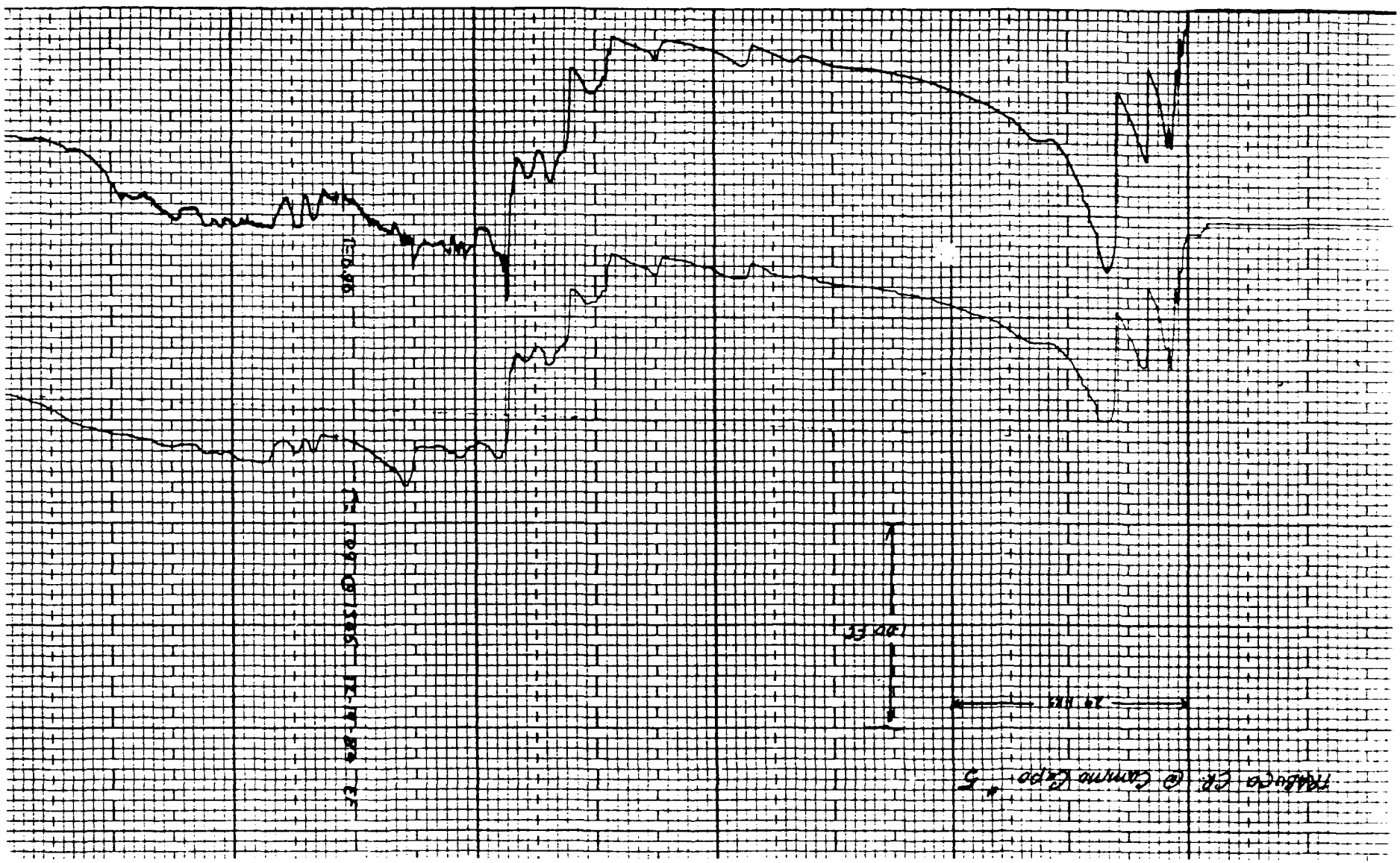
CHANNEL: CONCRETE RECTANGULAR WITH V-BOTTOM.

PERIOD OF RECORD: NOVEMBER 1971 TO PRESENT.

3. Typical charts from recording gages, from the Orange County Environmental Management Agency.

Westminster Chemist




100 ft
20 min

4. Descriptions of gages, from U.S. Geological Survey Publications

SAN DIEGO CREEK BASIN

11048500 SAN DIEGO CREEK AT SAND CANYON AVENUE, NEAR IRVINE, CA

LOCATION.--Lat 33°39'50", long 117°46'16", in San Joaquin Grant, Orange County, Hydrologic Unit 18070204, on downstream side of Sand Canyon Avenue bridge, 1.0 mi (1.6 km) southwest of East Irvine, and 2.8 mi (4.5 km) east of Irvine.

DRAINAGE AREA.-- ` 5 mi² (104.9 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD. October 1949 to current year. Prior to October 1976 published as "near Irvine".

GAGE.--Water-stage recorder. Altitude of gage is 140 ft (42.7 m), from topographic map. Prior to Oct. 1, 1976, at site 1.0 mi (1.6 km) downstream at different datum.

REMARKS.--Records poor. Sewage inflow and irrigation runoff cause low-flow fluctuations in discharge.

COOPERATION.--Eight discharge measurements were furnished by Orange County Environmental Management Agency.

AVERAGE DISCHARGE.--31 years, 5.81 ft³/s (0.165 m³/s), 4,210 acre-ft/yr (5.19 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,720 ft³/s (219 m³/s) Feb. 16, 1980, gage height, 21.17 ft (6.453 m), from rating curve extended above 605 ft³/s (17.1 m³/s) on basis of slope-area measurement at gage height 19.55 ft (5.959 m); no flow for long periods in most years.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 1,500 ft³/s (42.5 m³/s) and maximum (*), from rating curve extended as explained above.

Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)	Date	Time	Discharge (ft³/s)	Discharge (m³/s)	Gage height (ft)	Gage height (m)
Jan. 11	0630	4,050	115	18.61	5.672	Feb. 16	2030	*7,720	219	21.17	6.453
Jan. 29	0230	5,230	148	19.55	5.959	Feb. 20	2230	3,780	107	18.24	5.560
Feb. 13	1330	7,360	208	20.96	6.389	Mar. 2	1815	1,520	43.0	15.51	4.727

Minimum daily discharge, 0.83 ft³/s (0.024 m³/s) June. 17.

ALISO CREEK BASIN

475. Aliso Creek at El Toro, Calif.

Location.--Lat 33°37'34", long 117°41'03", in Canada de los Alisos Grant, at downstream side of right abutment of Second Street Bridge at El Toro, Orange County.

Drainage area.--8.5 sq mi, approximately.

Records available.--October 1930 to September 1960.

Gage.--Water-stage recorder. Altitude of gage is 440 ft (from topographic map).

Average discharge.--30 years (1930-60), 0.72 cfs (521 acre-ft per year); median of yearly mean discharges, 0.3 cfs (220 acre-ft per year).

Extremes.--1930-60: Maximum discharge, 1,950 cfs Feb. 6, 1937; no flow for most of each year.

Cooperation.--Records furnished by Orange County Flood Control District.

SANTA ANA RIVER BASIN

11078000 SANTA ANA RIVER AT SANTA ANA, CA

LOCATION.--Lat 33°44'56", long 117°54'30", in SW¼SE¼ sec.10, T.5 S., R.10 W., Orange County, Hydrologic Unit 18070203, on right bank 50 ft (15 m) downstream from Fifth Street Bridge in Santa Ana and 1.8 mi (2.9 km) downstream from Santiago Creek. Prior to Nov. 29, 1979, at site 50 ft (15 m) upstream.

DRAINAGE AREA.--1,700 mi² (4,403 km²), excludes 768 mi² (1,989 km²) above Lake Elsinore.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1923 to current year.

REVISED RECORDS.--WDR CA-74-1: Drainage area. WDR CA-79-1: 1978 (M).

GAGE.--Water-stage recorder. Datum of gage is 61.23 ft (14.082 m) Orange County datum. Jan. 3, 1923, to Jan. 24, 1929, at same site at different datum. Jan. 25, 1929, to June 20, 1948, at site 450 ft (137 m) upstream at different datum. June 21, 1948, to May 2, 1960, at same site at different datum. Feb. 28, 1961, to Oct. 1, 1961, at same site at datum 27.00 ft (8.230 m) higher. Oct. 2, 1961, to Nov. 28, 1979, at same site at datum 25.00 ft (7.620 m) higher. Nov. 29, 1979, at same site at datum 20.00 ft (6.096 m) higher. Apr. 21, 1980, to Aug. 14, 1981, no gage due to rebuilding of channel.

REMARKS.--Records good except those below 5 ft³/s (0.142 m³/s), which are poor. Natural flow affected by ground-water withdrawals, diversions, importation by Metropolitan Water District, municipal use, return flow from irrigation. Since 1940, natural flow affected by Prado flood-control reservoir, capacity, 201,200 acre-ft (248 hm³), three small flood-control reservoirs, combined capacity, 31,900 acre-ft (39.3 hm³), Big Bear Lake (station 11049000), and Santiago Reservoir, capacity, 25,000 acre-ft (30.8 hm³). Discharge up to 100 ft³/s (2.83 m³/s) can be diverted from Carbon Creek to Coyote Creek 1.5 mi (2.4 km) upstream from mouth of Carbon Creek. See schematic diagram of Santa Ana River basin.

AVERAGE DISCHARGE.--17 years (water years 1924-40), 23.4 ft³/s (0.663 m³/s), 16,940 acre-ft/yr (20.9 hm³/yr); 42 years (unadjusted for storage since 1940) 46.4 ft³/s (1.314 m³/s) 33,620 acre-ft/yr (41.5 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 46,300 ft³/s (1,310 m³/s) Mar. 3, 1938, gage height, 10.20 ft (3.109 m), site and datum then in use, on basis of slope-area measurement of maximum flow; no flow for several months in each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,770 ft³/s (107 m³/s) Apr. 2, gage height, 5.94 ft (1.811 m); no flow many days during the year.

SANTA ANA RIVER BASIN

11078000 SANTA ANA RIVER AT SANTA ANA, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968-71, 1973 to current year.
WATER TEMPERATURES: Water years 1968-71, 1973 to current year.
SEDIMENT RECORDS: Water years 1968-71, 1973 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1967 to September 1969, October 1970 to September 1971, October 1972 to September 1980, October 1981 to September 1982.
SEDIMENT RECORDS: October 1967 to September 1971, October 1972 to September 1980, October 1981 to September 1982.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean (water years 1968-71, 1973-80, 1982), 78,000 mg/L Feb. 25, 1969; minimum daily mean, no flow for many days each year.
SEDIMENT DISCHARGE: Maximum daily (water years 1968-71, 1973-80, 1982), 2,670,000 tons (2,420,000 metric tons) Feb. 25, 1969; minimum daily, 0 tons on many days each year.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 3,580 mg/L Apr. 2; minimum daily mean, no flow for many days.
SEDIMENT DISCHARGE: Maximum daily, 31,900 tons (28,900 metric tons) Apr. 2; minimum daily, 0 tons on many days.

SANTA ANA RIVER BASIN

11078000 SANTA ANA RIVER AT SANTA ANA, CA

LOCATION.--Lat 33°44'56", long 117°54'30", in SW¼SE¼ sec.10, T.5 S., R.10 W., Orange County, Hydrologic Unit 18070203, on right bank 50 ft (15 m) downstream from Fifth Street Bridge in Santa Ana and 1.8 mi (2.9 km) downstream from Santiago Creek. Prior to Nov. 29, 1979, at site 50 ft (15 m) upstream.

DRAINAGE AREA.--1,700 mi² (4,403 km²), excludes 768 mi² (1,989 km²) above Lake Elsinore.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1923 to current year.

REVISED RECORDS.--WDR CA-74-1: Drainage area. WDR CA-79-1: 1978 (M).

GAGE.--Water-stage recorder. Datum of gage is 61.23 ft (14.082 m) Orange County datum. Jan. 3, 1923, to Jan. 24, 1929, at same site at different datum. Jan. 25, 1929, to June 20, 1948, at site 450 ft (137 m) upstream at different datum. June 21, 1948, to May 2, 1960, at same site at different datum. Feb. 28, 1961, to Oct. 1, 1961, at same site at datum 27.00 ft (8.230 m) higher. Oct. 2, 1961, to Nov. 28, 1979, at same site at datum 25.00 ft (7.620 m) higher. Nov. 29, 1979, at same site at datum 20.00 ft (6.096 m) higher. Apr. 21, 1980, to Aug. 14, 1981, no gage due to rebuilding of channel.

REMARKS.--Records good except those below 5 ft³/s (0.142 m³/s), which are poor. Natural flow affected by ground-water withdrawals, diversions, importation by Metropolitan Water District, municipal use, return flow from irrigation. Since 1940, natural flow affected by Prado flood-control reservoir, capacity, 201,200 acre-ft (248 hm³), three small flood-control reservoirs, combined capacity, 31,900 acre-ft (39.3 hm³), Big Bear Lake (station 11049000), and Santiago Reservoir, capacity, 25,000 acre-ft (30.8 hm³). Discharge up to 100 ft³/s (2.83 m³/s) can be diverted from Carbon Creek to Coyote Creek 1.5 mi (2.4 km) upstream from mouth of Carbon Creek. See schematic diagram of Santa Ana River basin.

AVERAGE DISCHARGE.--17 years (water years 1924-40), 23.4 ft³/s (0.663 m³/s), 16,940 acre-ft/yr (20.9 hm³/yr); 42 years (unadjusted for storage since 1940) 46.4 ft³/s (1.314 m³/s) 33,620 acre-ft/yr (41.5 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 46,300 ft³/s (1,310 m³/s) Mar. 3, 1938, gage height, 10.20 ft (3.109 m), site and datum then in use, on basis of slope-area measurement of maximum flow; no flow for several months in each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,770 ft³/s (107 m³/s) Apr. 2, gage height, 5.94 ft (1.811 m); no flow many days during the year.

SANTA ANA RIVER BASIN

780. Santa Ana River at Santa Ana, Calif.

Location.--Lat 33°44'56", long 117°54'30", in [illegible] sec.10, T.5 S., R.10 W., on downstream side of right pier of Fifth Street Bridge in Santa Ana, 1.8 miles downstream from Santiago Creek.

Drainage area.--1,625 sq mi.

Records available.--January 1923 to September 1960.

Gage.--Water-stage recorder. Altitude of gage is 80 ft (from topographic map). Prior to Jan. 24, 1929, at datum 1.00 ft higher. Jan. 25, 1929, to June 20, 1948, at site 450 ft upstream at different datum.

Average discharge.--20 years (1940-60), 15.2 cfs (11,000 acre-ft per year); median of yearly mean discharges, 1.5 cfs (1,100 acre-ft per year).

Extremes.--1923-60: Maximum discharge, 46,300 cfs Mar. 3, 1938 (gage height, 10.20 ft, site and datum then in use), on basis of slope-area measurement of peak flow; no flow for several months in each year.

Remarks.--Natural flow affected by ground-water withdrawals, diversions, importation from Metropolitan Water District, municipal use, return flow from irrigation, and several storage reservoirs, including Prado flood-control reservoir (capacity, 222,800 acre-ft), and Big Bear Lake. At times there are small amounts of return irrigation water from Santa Ana Valley Irrigation Co.'s drain 1,500 ft upstream.

LOS ANGELES RIVER BASIN

11103000 LOS ANGELES RIVER AT LONG BEACH, CA
(National stream-quality accounting network station)

LOCATION.--Lat 33°49'02", long 118°12'20", in Los Cerritos Grant, Los Angeles County, Hydrologic Unit 18070105, on right bank 5,000 ft (1,524 m) upstream from Willow Street, 3.4 mi (5.5 km) north of Long Beach, and 3.7 mi (6.0 km) upstream from mouth.

DRAINAGE AREA.--827 mi² (2,140 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--December 1928 to current year.

GAGE.--Water-stage recorder. Datum of gage is 11.91 ft (3.630 m) National Geodetic Vertical Datum of 1929 (levels by Los Angeles County Flood Control District). See WSP 1735 for history of changes prior to Jan. 19, 1956.

REMARKS.--Flow regulated since September 1940 by Hansen flood-control reservoir, since December 1941 by Sepulveda flood-control reservoir, combined capacity, 49,400 acre-ft (60.9 hm³), and several small flood-control reservoirs. City of Los Angeles stores imported Owens River water in San Fernando and Chatsworth reservoirs and at times discharges imported water into Los Angeles River above station. Many diversions above station for domestic use and irrigation. AVERAGE DISCHARGE represents flow to the ocean, regardless of upstream development. See schematic diagram of San Gabriel and Los Angeles River basins.

COOPERATION.--Records furnished by Los Angeles County Flood Control District.

AVERAGE DISCHARGE.--53 years (water years 1930-82), 199 ft³/s (5.635 m³/s), 144,180 acre-ft/yr (178 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 129,000 ft³/s (3,650 m³/s) Feb. 16, 1980, gage height, 17.99 ft (5.483 m); no flow at times in 1929-30, 1934.

EXTREMES FOR WATER YEAR 1980.--Maximum discharge, 129,000 ft³/s (3,650 m³/s) Feb. 16, gage height, 17.99 ft (5.483 m); minimum daily, 39 ft³/s (1.104 m³/s) July 6.
WATER YEAR 1981: Maximum discharge, 24,200 ft³/s (685 m³/s) Mar. 1, gage height, 7.19 ft (2.192 m); minimum daily, 27 ft³/s (0.764 m³/s) Nov. 16.
WATER YEAR 1982: Maximum discharge, 26,800 ft³/s (759 m³/s) Apr. 1, gage height, 7.19 ft (2.192 m); minimum daily 32 ft³/s (0.906 m³/s) Sept. 23.

LOS ANGELES RIVER BASIN

1090. Los Angeles River at Long Beach, Calif.

Location.--Lat 33°49'05", long 118°12'15", in Los Cerritos Grant, on right bank 5,000 ft upstream from Willow Street, 3.4 miles north of Long Beach, Los Angeles County, and 3.7 miles upstream from mouth.

Records available.--December 1928 to September 1960.

Gage.--Water-stage recorder. Datum of gage is 11.91 ft above mean sea level (levels by Los Angeles County Flood Control District). Prior to Oct. 31, 1931, at site 3 miles downstream at different datum. Oct. 31, 1931, to Jan. 19, 1956, at site 2 miles downstream at different datum.

Average discharge.--31 years (1929-60), 139 cfs (100,600 acre-ft per year); median of yearly mean discharges, 88 cfs (63,700 acre-ft per year).

Extremes.--1928-60: Maximum discharge, 99,000 cfs Mar. 2, 1938, on basis of records for stations upstream; no flow at times in 1929-30, 1934.

Remarks.--Flow regulated by Hansen and Sepulveda flood-control reservoirs (combined capacity, 49,400 acre-ft) and several small flood-control reservoirs. City of Los Angeles stores imported Owens River water in San Fernando and Chatsworth reservoirs and at times discharges imported water into Los Angeles River above station. Many diversions above station for irrigation and domestic use.

Cooperation.--Records furnished by Los Angeles County Flood Control District.

SAN GABRIEL RIVER BASIN

880. San Gabriel River at Spring Street, near Los Alamitos, Calif.

Location.--Lat 33°48'38", long 118°05'24", in NE¼NE¼SW¼ sec.24, T.4 S., R.12 W., on downstream side of Spring Street Bridge, 1.2 miles upstream from Coyote Creek and 1.2 miles northwest of Los Alamitos.

Drainage area.--216 sq mi (excluding area above Santa Fe Dam).

Records available.--October 1927 to September 1951, October 1952 to September 1960. Monthly discharge only for some periods, published in WSP 1315-B.

Gage.--Water-stage recorder. Datum of gage is 12.25 ft above mean sea level, datum of 1929, supplementary adjustment of 1934. Prior to October 1952, at datum 4.44 ft higher.

Average discharge.--32 years (1927-51, 1952-60), 23.8 cfs (17,230 acre-ft per year); median of yearly mean discharges, 2.2 cfs (1,600 acre-ft per year).

Extremes.--1936-51, 1952-60: Maximum discharge, 27,000 cfs (estimated) Mar. 2, 1938; no flow for several months in each year.

Remarks.--Flow regulated by San Gabriel and Cogswell flood-control reservoirs (combined capacity, 54,5[illegible] acre-ft), Morris Reservoir (capacity, 35,200 acre-ft), Santa Fe flood-control reservoir (capacity, 36,800 acre-ft), Whittier Narrows flood-control reservoir (capacity, 36,[illegible]00 acre-ft), and several small flood-control reservoirs (combined capacity, [illegible]9,[illegible] acre-ft). Many diversions above station for irrigation, power development, and ground-water replenishment. "Average discharge" represents flow to ocean during period of record, regardless of upstream development. At times flow is diverted from San Gabriel River below Santa Fe Dam and above Whittier Narrows Dam to Rio Hondo.

Cooperation.--Records furnished by Los Angeles County Flood Control District.

MALIBU CREEK BASIN

1055. Malibu Creek at Crater Camp, near Calabasas, Calif.

Location.--Lat 34°04'38", long 118°42'03", in SW¼ sec.18, T.1 S., R.17 W., on right bank 700 ft downstream from Cold Creek, 0.2 mile downstream from Crater Camp, and 6 miles southwest of Calabasas.

Drainage area.--103 sq mi.

Records available.--January 1931 to September 1960.

Gage.--Water-stage recorder. Datum of gage is 430.51 ft above mean sea level (levels by Los Angeles County Flood Control District).

Average discharge.--29 years (1931-60), 18.3 cfs (13,250 acre-ft per year); median of yearly mean discharges, 6.4 cfs (4,600 acre-ft per year).

Extremes.--1931-60: Maximum discharge, 13,600 cfs Mar. 15, 1952 (gage height, 19.1 ft); no flow at times in some years.

Remarks.--Flow regulated by many small recreational reservoirs.

Cooperation.--Records furnished by Los Angeles County Flood Control District.

TOPANGA CREEK BASIN

1040. Topanga Creek near Topanga Beach, Calif.

Location.--Lat 34°03'50", long 118°35'10", in Boca de Santa Monica Grant, on downstream side of right abutment of highway bridge, 1.7 miles north of Topanga Beach, Los Angeles County.

Drainage area.--17.9 sq mi.

Records available.--January 193[illegible] to September 1938, October 1939 to September 1960.

Gage.--Water-stage recorder. Datum of gage is 265.60 ft above mean sea level (levels by Los Angeles County Flood Control District). Prior to June 5, 1940, at different datum. June 5, 1940, to Dec. 9, 1941, at site 400 ft upstream at different datum.

Average discharge.--29 years (1930-38, 1939-60), 5.14 cfs (3,710 acre-ft per year); median of yearly mean discharges, 1.8 cfs (1,300 acre-ft per year).

Extremes.--193[illegible]-38, 1939-60: Maximum discharge, [illegible],960 Mar. 2, 1938; no flow at times.

Cooperation.--Records furnished by Los Angeles County Flood Control District.

5. Debris production history from the Los Angeles County Department of Public Works

DEBRIS PRODUCTION HISTORY

Including 1983-1984 Season

DATA SHEET B

Compiled by Hydraulic Division
L.A.C.F.C.D.

as of AUGUST, 1984

DEBRIS BASIN	FIRST DEBRIS SEASON	NUMBER OF SEASONS	TOTAL DEBRIS DEPOSITED CU. YDS. (1)	UNCONTROLLED DRAINAGE AREA ABOVE BASIN SQ. MI.	MAX. DEB. CAP. CU. YDS.	MAXIMUM SEASONAL DEBRIS PRODUCTION CU. YDS.	CU. YDS. PER SQ. MI.	SEASON
AFTON	1974-75	10	1,000	0.06	7,200	800	13,800	1974-75
ALISO	1970-71	14	129,200	2.77	41,700 (6)	30,700	11,100	1982-83
ANNETTE JO	1977-78	7	300	0.08	200	100	1,600	1977-78
ARBOR DELL	1971-72	13	1,400	0.11	12,800	800	7,600	1979-80
AUBURN	1954-55	30	87,300	0.19	35,900	20,100	105,900	1961-62
BAILEY	1945-46	39	237,500	0.60	137,600	91,600	152,700	1979-80
BAKERTON	1980-81	4	800	0.25	2,700	700	2,800	1979-80
BARCOTTA	1970-71	14	100	0.12	2,000	50	400	1982-83
BEATTY	1970-71	14	13,100	0.27	43,000	7,600	28,300	1979-80
BIGBRIAR	1971-72	13	500	0.02	3,100	300	12,400	1982-83
BIG DALTON	1959-60	25	833,000	2.62	534,400	296,700	113,200	1968-69
BLANCHARD	1968-69	16	67,600	0.50	75,300	36,600	73,200	1977-78
BLUE GUM	1968-69	16	37,800	0.19	39,600	19,100	100,600	1977-78
BRACE	1971-72	13	35,400	0.29	27,500	12,000	41,300	1977-78
BRADBURY	1954-55	30	267,400	0.68	80,500	70,200	103,200	1968-69
BRAND	1935-36	49	247,200	1.01	170,700	53,100	51,600	1977-78
CALLE ROBLEDA	1982-83	2	2,000	0.11	1,400	2,000	18,400	1982-83
CARRIAGE HOUSE	1970-71	14	4,700	0.03	10,400	1,400	116,700	1979-80
CARTER	1954-55	30	36,900	0.12	18,700	12,600	104,700	1979-80
CASSARA	1976-77	8	23,800	0.21	27,200	16,800	80,000	1977-78
CEDARWOOD	1983-84	1	NEG.	0.01	900	-	-	-
CHAMBERLAIN	1974-75	10	500	0.04	6,600	300	7,900	1974-75
CHILDS	1963-64	21	45,200	0.31	47,800	10,700	34,500	1980-81
CLOUD CREEK	1972-73	12	3,200	0.02	14,800	1,800	91,600	1977-78
CLOUDCROFT	1973-74	11	12,300	0.21	31,800	6,100	28,900	1973-74
COORS	1951-52	33	112,000	0.58	46,900	61,200	105,600	1977-78
COPPER HILL	1979-80	5	1,100	0.27	7,900	1,100	4,300	1981-82
CROCKER	1983-84	1	NEG.	0.67	39,200	-	-	-
DARRON	1979-80	5	400	0.13	9,200	400	3,200	1982-83
DEER	1954-55	30	151,300	0.59	56,600	44,200	74,900	1968-69
DENIVELLE	1976-77	8	8,700	0.18	8,200	5,500	30,400	1977-78
DEVONWOOD	1981-82	3	100	0.05	6,400	100	2,600	1982-83
DRY CANYON-SOUTH FORK	1978-79	6	6,000	1.05	7,900	5,300	5,100	1979-80
DUNSMUIR	1935-36	49	346,400	0.84	110,900	86,200	102,600	1977-78
EAGLE	1936-37	48	199,000	0.48	56,600	41,700	68,100	1937-38
ELMWOOD	1964-65	20	49,100	0.31	61,900	16,100	51,900	1980-81
EMERALD EAST	1964-65	20	7,100	0.16	13,900	1,600	10,000	1968-69
ENGLEWILD	1961-62	23	85,100 (2)	0.40	36,900	60,200	150,500 (2)	1968-69
FAIR OAKS	1935-36	49	108,900	0.21	25,200	15,700	74,800	1935-36
FERN	1935-36	49	159,600	0.30	30,600	23,900	79,600	1968-69
FIELDBROOK	1974-75	10	1,400	0.35	1,300	500	1,400	1977-78
FLOWERPARK	1972-73	12	1,300	0.08	1,300	900	10,800	1982-83
FOXLANE	1979-80	5	700	0.19	11,900	800	3,800	1979-80
GOLF CLUB DRIVE	1970-71	14	29,200	0.32	14,700	11,600	36,300	1979-80
GORDON	1973-74	11	4,500	0.16	16,800	1,800	21,200	1977-78
GOULD	1947-48	37	113,300	0.47	49,600	18,000	38,300	1965-66
GOULD (UPPER)	1971-72	13	17,100	0.18	52,000	10,100	55,900	1977-78
HALLS	1935-36	49	568,000	0.86	85,000	102,100	96,300	1937-38
HARROW	1958-59	26	76,800 (2)	0.43	68,000	63,400	147,400 (2)	1968-69
HAY	1936-37	48	63,000	0.20	36,100	18,200	63,000	1937-38
HILLCREST	1962-63	22	45,600	0.35	54,400	11,700	33,300	1964-65
HOG	1969-70	15	6,400	0.30	41,900	3,800	12,800	1977-78
HOOK EAST	1968-69	16	45,700 (2)	0.18	23,100	40,200	223,100 (2)	1968-69
HOOK WEST	1970-71	14	5,400	0.17	39,600	3,600	21,200	1979-80
INVERNESS	1982-83	2	900	0.01	1,800	800	38,400	1982-83
IRVING DRIVE	1974-75	10	1,100	0.01	2,100	400	18,300	1982-83
JASMINE	1976-77	8	2,500	0.10	5,500	1,100	10,700	1982-83
KINNELOA	1964-65	20	48,900 (2)	0.20	17,200	17,600	88,100 (2)	1968-69
KINNELOA WEST	1966-67	18	58,200 (2)	0.16	23,600	22,200	138,500 (2)	1968-69
LANNAN	1954-55	30	84,100	0.25	44,600	18,200	73,000	1969-70
LA SALLE	1979-80	5	1,200	0.22	14,900	1,200	5,500	1982-83
LAS FLORES	1935-36	49	213,900	0.45	57,600	36,000	80,000	1937-38
LAS LOMAS	1983-84	1	0	0.07	9,300	-	-	-
LA TUNA	1955-56	29	592,700	5.34	482,300	172,000	32,200	1977-78
LAUREL RIDGE	1977-78	7	400	0.03	1,700	200	5,600	1979-80
LIMEKILN	1963-64	21	264,300	1.69	171,300	42,300	11,500	1965-66
LINCOLN	1935-36	49	124,700	0.50	38,400	28,400	56,800	1968-69
LINDA VISTA	1970-71	14	10,200	0.37	3,200	3,400	9,200	1977-78
LITTLE DALTON	1959-60	25	905,200	3.31	656,500	337,800	102,100	1968-69
MADDOCK	1954-55	30	56,200	0.25	45,900	16,200	64,700	1980-81
MAY NO. 1	1953-54	31	202,800	0.70	64,000	26,300	91,900	1966-67
MAY NO. 2	1953-54	31	27,300	0.09	10,500	6,200	68,600	1966-67
MEANDERING CREEK	1973-74	11	1,700	0.09	3,000	900	9,800	1973-74
MONUMENT CANYON	1981-82	3	2,900	0.11	8,400	2,600	24,000	1981-82
MORGAN	1964-65	20	29,500	0.60	51,100	12,900	21,500	1968-69
MOUNTBATTEN	1983-84	1	0	0.01	1,400	-	-	-
MULL	1973-74	11	2,000	0.15	16,400	1,100	7,000	1979-80
MULLALLY	1974-75	10	51,700 (4)	0.34	12,000	24,400	71,900 (4)	1977-78
NADAL	1969-70	15	500	0.08	1,400	400	5,600	1979-80
NICHOLS	1917-18	47	121,600	0.35	13,100	21,800	62,300	1951-52
OAK	1975-76	9	13,300	0.05	8,700	6,900	138,200	1977-78
OAKGLADE	1974-75	10	1,500	0.06	12,300	1,200	20,700	1977-78
PICKENS	1935-36	49	713,800	1.50	131,400	140,600	93,700	1977-78
PINELANN	1973-74	11	5,100	0.02	5,800	1,200	60,000	1976-77
ROMLEY	1932-33	31	48,500 (4)	0.27	34,100	16,200	61,100 (4)	1977-78
ROMLEY (UPPER)	1976-77	8	48,700 (4)	0.31	28,800	11,900	102,800 (4)	1977-78
RUBIO	1943-44	41	271,700	1.26	127,200	133,000	105,600	1979-80
RUBY (LOWER)	1955-56	29	20,400	0.28	28,600	8,300	29,700	1968-69
RYE	1981-82	3	10,400	1.11	18,000	10,000	9,100	1981-82
SANTA ANITA	1959-60	25	689,400 (2,3)	1.70	393,900	132,000	77,600 (2,3)	1961-62
SANPIT	1954-55	30	678,600 (2,3)	2.78	644,500	233,800	82,500 (2,3)	1968-69
SCHOLL	1945-46	39	16,200	0.66	11,100	3,500	5,200	1968-69
SCHOOLHOUSE	1962-63	22	33,600	0.28	66,700	21,600	77,200	1962-63
SCHWARTZ	1976-77	8	44,900	0.27	45,400	23,400	86,500	1977-78
SHIELDS	1937-38	47	131,800 (3)	0.03	14,800	15,100	110,200	1937-38
SIERRA MADRE	1937-38	47	361,700 (2)	2.39	133,600	95,200	39,800 (2)	1968-69
SIERRA MADRE VILLA	1957-58	27	499,700	1.46	402,700	118,600	81,200	1961-62
SNOVER	1936-37	48	104,300	0.23	23,400	21,100	91,700	1938-39
SNOW DROP	1976-77	8	1,700	0.14	4,100	1,000	7,400	1979-80
SOMBRERO	1969-70	15	4,300	1.06	84,300	3,300	3,100	1977-78
SPINKS	1958-59	26	67,100	0.44	62,900	16,400	37,200	1968-69
STARFALL	1973-74	11	27,000	0.13	18,400	14,200	109,200	1977-78
STETSON	1969-70	15	4,900	0.29	40,000	1,500	5,300	1977-78
STOUGH	1940-41	44	159,100	1.65	181,200	44,100	26,700	1964-65
STUYVESANT	1967-68	17	1,300	0.03	2,100	500	16,900	1977-78
SULLIVAN	1970-71	14	89,500	2.38	45,800	35,300	14,800	1979-80
SUNNYSIDE	1970-71	14	1,800	0.02	4,300	800	41,000	1978-79
SUNSET CANYON-DEER	1982-83	2	3,700	0.20	6,400	3,200	16,000	1982-83
SUNSET (LOWER)	1963-64	21	136,600	0.65	160,600	29,200	44,900	1980-81
SUNSET (UPPER)	1928-29	56	142,600	0.44	15,900	27,000	61,400	1964-65
TURNBULL	1952-53	32	49,300 (2)	0.99	20,300	15,900	16,000 (2)	1968-69
UPPER SHIELDS	1976-77	8	39,700 (4)	0.20	5,700	(5)	(5)	
VERDUGO	1935-36	49	805,600	9.40	131,000	94,700	10,100	1977-78
WARD	1956-57	28	51,700	0.12	12,400	17,800	148,100	1977-78
WEST RAVINE	1935-36	49	148,200	0.25	46,800	29,900	119,500	1937-38
WILDWOOD	1967-68	17	67,400	0.65	22,500	16,700	25,700	1977-78
WILSON	1962-63	22	201,000	2.58	316,900	55,500	21,500	1968-69
WINERY	1968-69	16	22,400	0.18	29,200	9,400	52,200	1968-69
WONDER WAY	1975-76	9	NEG.	0.07	1,700	NEG.	300	1975-76
ZACHAU	1956-57	28	106,200 (4)	0.35	40,000	48,100	137,300 (4)	1977-78
120 DEBRIS BASINS			12,950,300	75.72			7,569,100	

(1) VOLUME OF DEBRIS DEPOSITED IN BASINS DOES NOT INCLUDE DEBRIS SLUICED THROUGH OPEN PORTS OR NOTCH.
(2) VOLUME OF DEBRIS DEPOSITED DOES NOT INCLUDE DEBRIS WHICH PASSED OVEN SPILLWAY DURING THE STORMS IN 1968-69 SEASON.
(3) INCLUDING DEBRIS FROM UPSTREAM BASIN OR DAM.
(4) VOLUME OF DEBRIS DEPOSITED DOES NOT INCLUDE DEBRIS WHICH PASSED OVER SPILLWAY DURING THE STORMS IN 1977-78 SEASON.
(5) INCLUDED WITH SHIELDS DEBRIS BASIN.
(6) DEBRIS CAPACITY AVAILABLE WITHIN RIGHT OF WAY LIMITS.

6. Unpublished monthly discharge (acre-feet) and annual peak flow (cfs) for major streams, Los Angeles County, 1977 through 1983.
Courtesy of Bob Sarasua, Los Angeles County
Department of Public Works

Station #

F3BCR Ballona Cr.

Monthly Values Ac Ft

1977 - 78

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	PEAK (CFS)
41	434	928	1838	2214	2284	3994	889	789	993	84	1109	2/10 Q 28088

1978 - 79

737	3500	2970	13440	6690	11600	786	901	793	705	742	815	3/21 Q 9710

1979 - 80

1660	961	1560	9920	38100	11900	1098	1100	975	1040	1100	1040	2/14 Q 27000

1980 - 81

781	790	509	4460	1890	6960	1130	671	720	835	726	636	3/2 Q 7300

1981 - 82

860	3850	1410	4860	1490	7990	4470	844	749	779	852	1980	4/1 Q 8110

1982. 83

898	8750	2570	16780	9730	26690	9730	1460	1030	1150	2740	4880	3/1 Q 23,100

Station #

F354R Coyote Creek

MONTHLY VALUES IN Ac Ft

√-1-84

OCT	N	D	J	F	M	A	M	J	J	A	S	(CFS) PEAK
182	245	9450	18720	28740	28140	3130	735	650	631	430	1910	3/1 Q 13700
1977 - 78												
764	3340	5130	26780	6670	NA	NA	532	567	NA	NA	516	NA
1978 - 79												
2210	898	1120	23660	11650	15530	1870	1540	931	898	777	710	2/14 Q 19400
1979 - 80												
1980 - 81												
947	1374	1450	6100	1140	11830	1170	494	1050	729	893	1280	11/28 Q 12200
1981 - 82												
1100	8760	3550	10120	16220	27870	8010	2210	3850	3090	1420	2820	3/1 Q 19,700
1982 - 83												

Station #

F319R Los Angeles River

V-1-8√

MONTHLY VALUES IN AC FT (CFS)

1977-78

OCT	N	D	J	F	M	A	M	J	J	A	S	PEAK
839	1110	+22√0	82910	163000	320160	35430	778√	2170	2580	2130	7√2√	2/10 Q 94,820

1978-79

33√6	√42√0	129√0	77920	30√00	62280	8300	7070	+790	4300	4050	3730	3/27 Q 60,900

1979-80

N.A.

1981-82

√431	1062	√9√0	23890	1720	√6270	34√40	6460	4470	3820	2690	6360	+/1 Q 26800

1982-83

4040	√3870	16770	85540	7160√0	380,√00	71250	+1120	5230	3950	11460	13070	3/1 Q 81,800

Station #
F130R MALIBU Creek

MONTHLY VALUES IN Ac Ft (CFS)

1977-78

OCT	N	D	J	F	M	A	M	J	J	A	S	PEAK
192	837	848	11700	12450	37890	4030	1580	772	465	398	407	3/4 Q 1940

1978-79

498	873	1060	9630	6240	8270	3320	1160	744	537	629	357	3/27 Q 4420

1979-80

405	506	534	5010	NA	NA	3000	1690	920	565	347	305	2/16 Q 42,170

1980-81

359	491	984	1240	1130	3530	818	498	306	180	136	166	3/5 Q 910

1981-82

212	783	720	1460	749	2380	1770	475	387	447	358	297	3/17 Q 676

1982-83

233	3350	2240	21430	12450	37310	5290	2490	1160	744	712	733	3/1 Q 24,200

Station H

F42BR SAN GABRIEL RIVER

1977-78

MONTHLY VALUES IN AC FT (CFS)

O	N	D	J	F	M	A	M	JUN	JUL	A	S	PEAK
2820	2580	5080	NA	NA	102,870	NA	NA	4260	NA	NA	3846	NA
					1978-79							
NA	NA	4830	10120	5840	6030	3190	2640	2790	2240	2000	2240	1/31 Q 4780
					1979-80							
3090	2000	2160	9910	98400	47000	4550	4009	2422	2160	3350	1600	2/14 Q 11000
					1980-81							
2170	1880	2550	NA	NA	NA	NA	4740	4400	2870	3430	NA	NA
					1981-82							
3670	3460	5380	5870	9500	5810	4770	4330	4370	3980	4270	4530	3/14 Q 1260
					1982-83							
5010	8150	7070	7380	13950	71200	8320	11120	7010	7260	6790	6770	3/1 Q 13,400

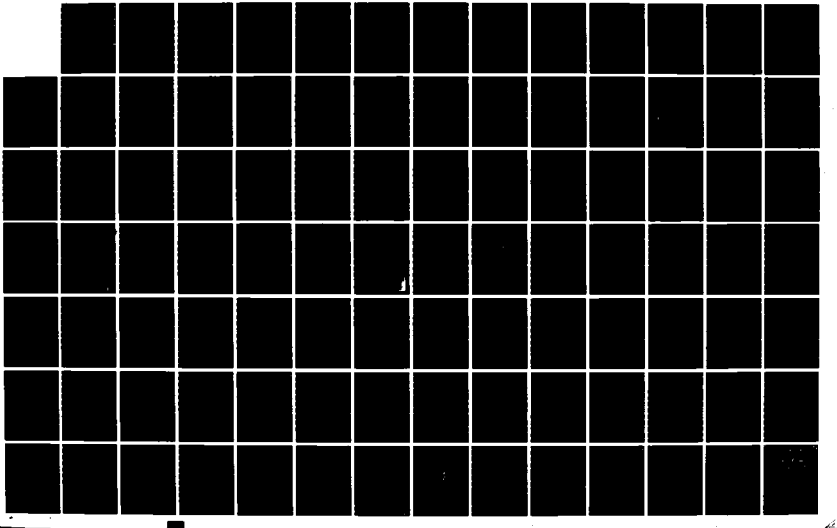
Station #
F301R Sawtelle - Westwood

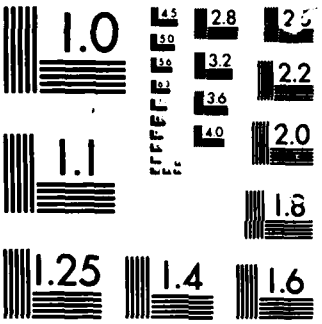
1978 - 79

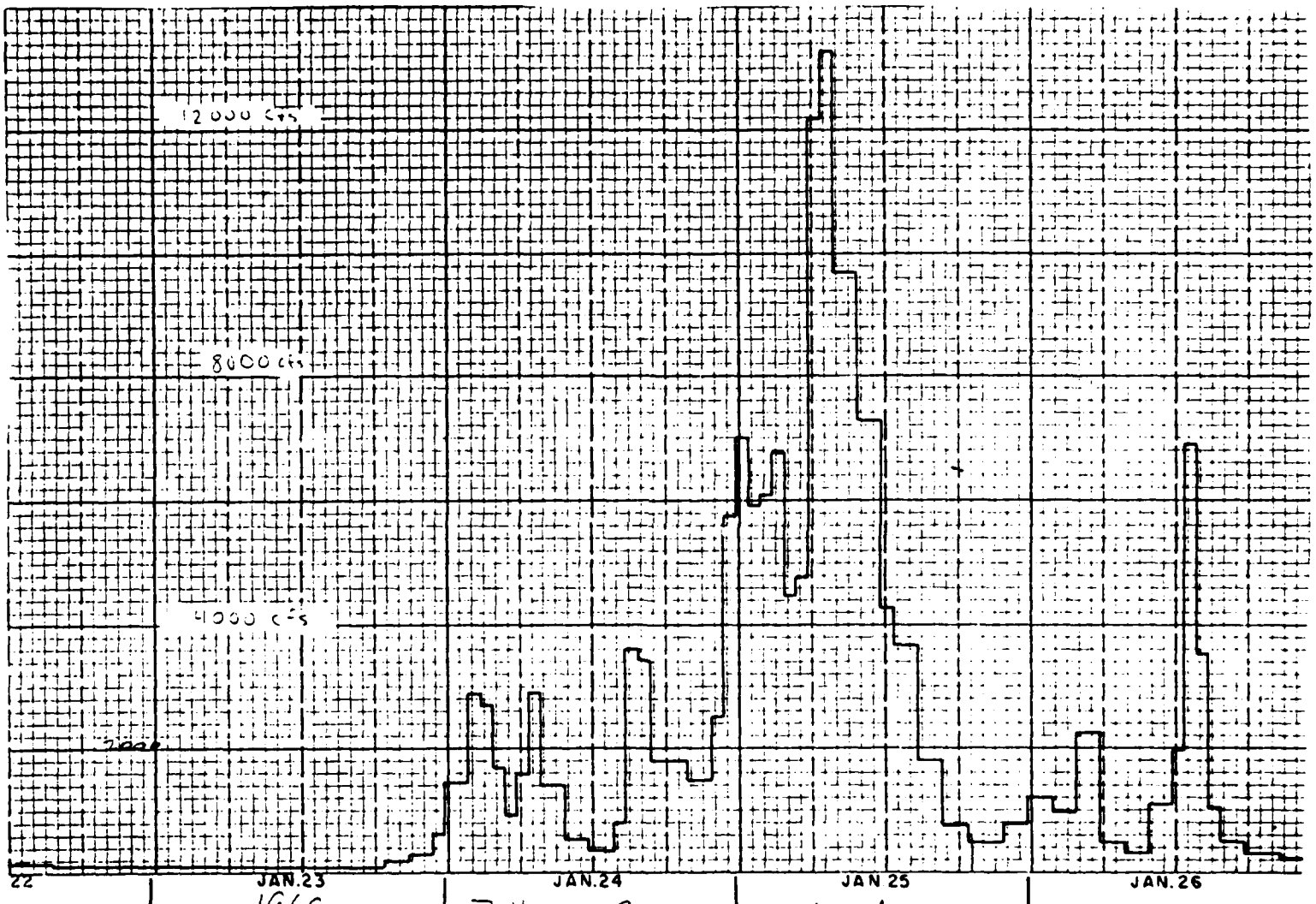
MONTHLY VALUES IN AC FT

OCT	N	D	J	F	M	A	M	J	J	A	S	PEAK (CFS)
376	818	798	3630	1770	2470	274	269	365	270	240	249	3/17 Q 4110
164	172	2350	3850	2210	1977 - 78 7090	762	319	359	337	358	372	2/10 Q 11,700
209	297	638	3630	12890	1979 - 80 3690	272	540	442	489	540	377	2/15 Q 12,700
429	364	990	1210	718	1980 - 81 2480	562	591	531	433	390	433	3/2 Q 7040
525	1180	782	1600	536	1981 - 82 2500	1290	542	296	304	276	640	3/14 Q 4360
334	2190	1020	4470	2300	1982 - 83 5630	1720	343	402	333	596	943	1/27 Q 8810

AD-A166 782 COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY 3/3
HYDRAULIC DATA INVENTORY..(U) ARMY ENGINEER DISTRICT
LLS ANGELES CA COASTAL RESOURCES BRANC.. DEC 85
UNCLASSIFIED CCSTWS-85-8 F/G 8/8 NL



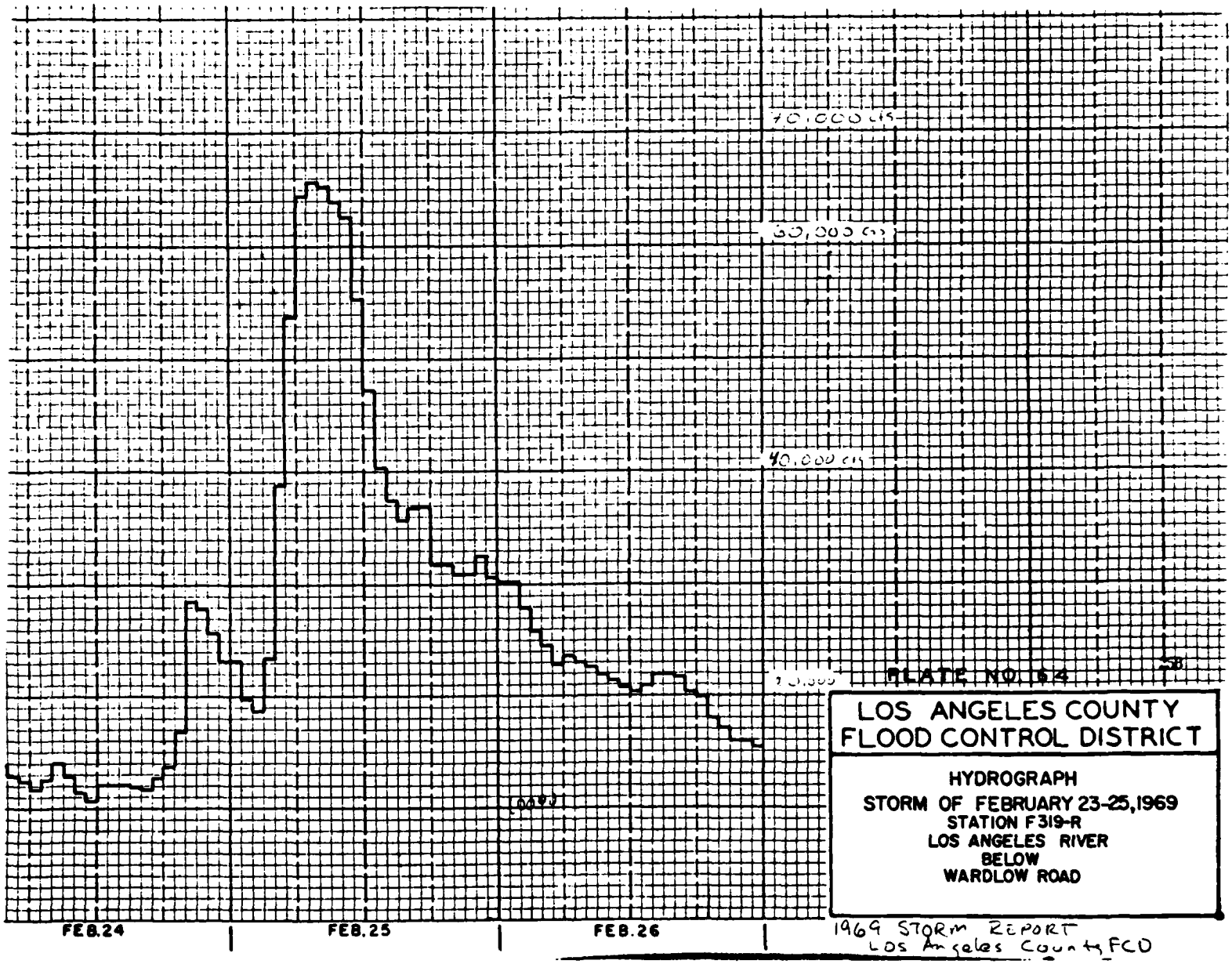

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.8
3.2
3.6
4.0
MICROCOPY
CHART

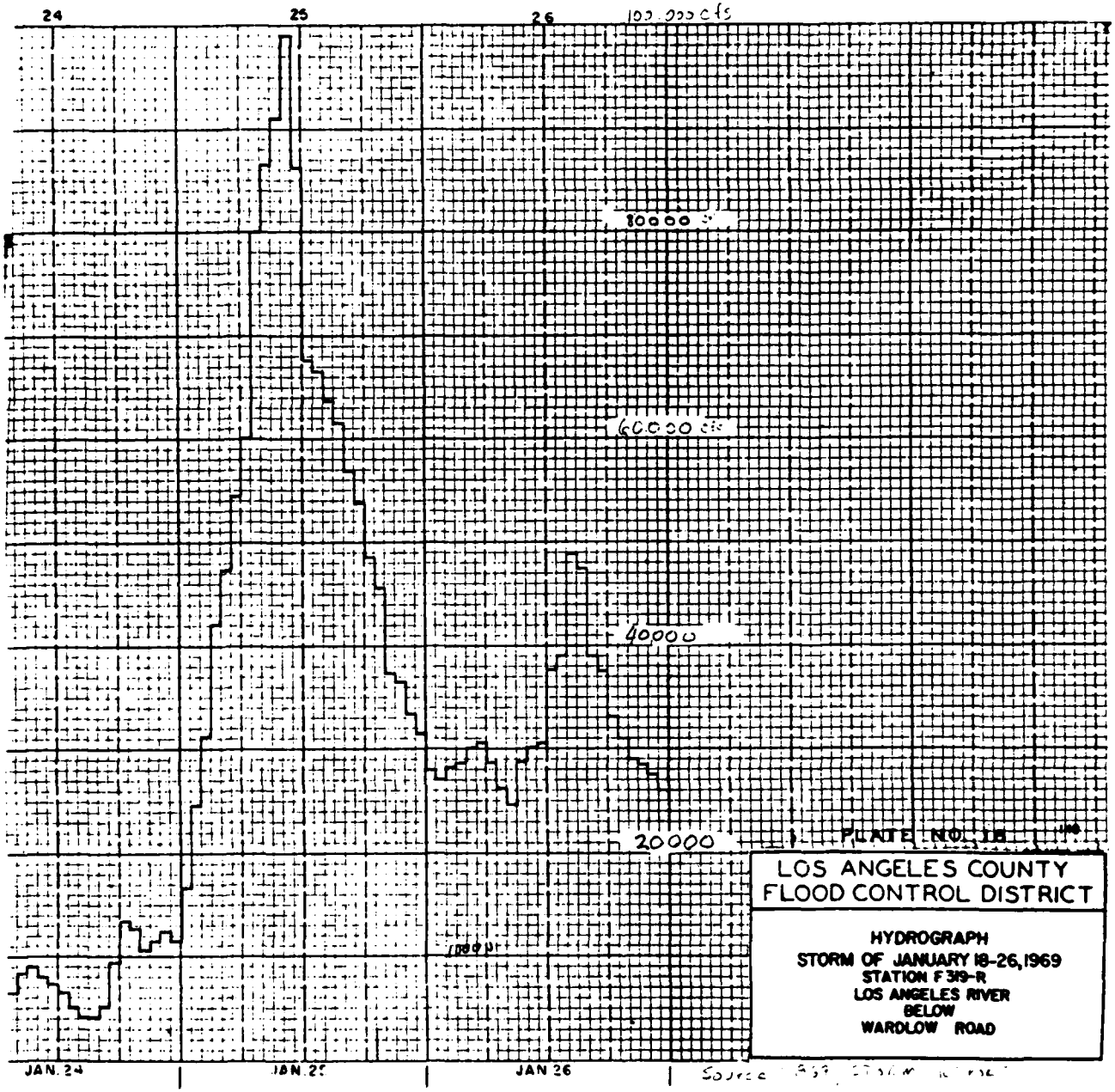


1969

Ballona Creek
Gage F-38C R

Los Angeles County Flood Control
(1969)


70,000 cfs
60,000 cfs
50,000 cfs
40,000 cfs
30,000 cfs
FEB. 24
FEB. 25
FEB. 26
PLATE NO. 64
LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT
HYDROGRAPH
STORM OF FEBRUARY 23-25, 1969
STATION F319-R
LOS ANGELES RIVER
BELOW
WARDLOW ROAD
1969 STORM REPORT
Los Angeles County FCD


24
25
26
100,000 cfs
80000
60000
40000
20000
10000
JAN. 24
JAN. 25
JAN 26
PLATE NO. 18
LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT
HYDROGRAPH
STORM OF JANUARY 18-26, 1969
STATION F 319-R
LOS ANGELES RIVER
BELOW
WARDLOW ROAD

7. Typical hydrographs of storm events, South Coast Region

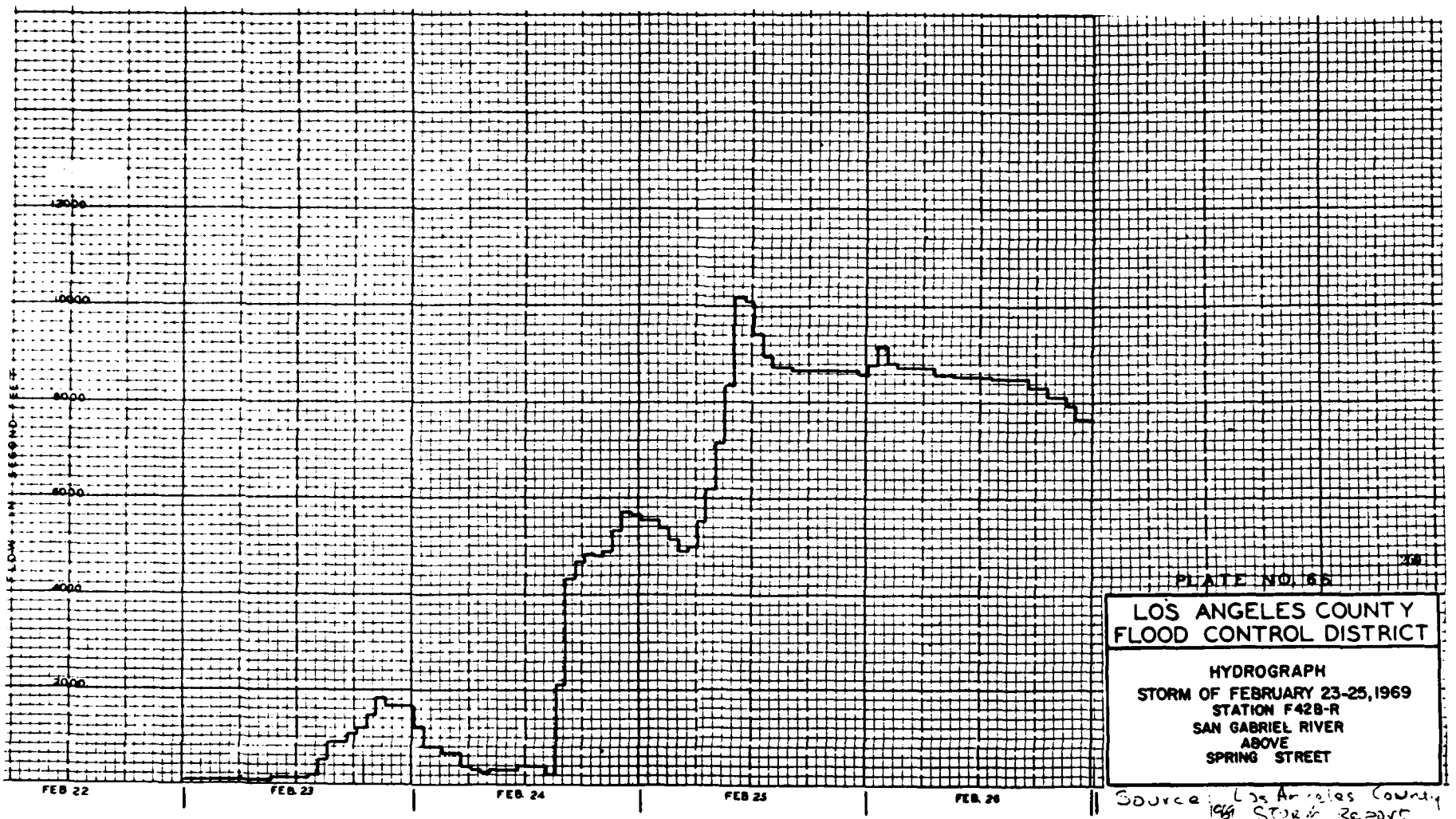


PLATE NO. 66

LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT

HYDROGRAPH
STORM OF FEBRUARY 23-25, 1969
STATION F42B-R
SAN GABRIEL RIVER
ABOVE
SPRING STREET

Source: Los Angeles County 1969 Storm Report

8. Sediment size distributions measured in South Coast streams, from U.S.G.S. publications and Brownlie and Taylor (1981)

11078000 SANTA ANA RIVER AT SANTA ANA, CALIF.

LOCATION.—Lat 33°44'56", long 117°54'30", in SW¼SW¼ sec.10, T.5 S., R.10 W., Orange County, at gaging station on Fifth Street Bridge in Santa Ana, 1.8 miles downstream from Santiago Creek.

DRAINAGE AREA.—1,000 sq mi, not including 700 sq mi upstream from Lake Elsinore.

PERIOD OF RECORD.—Water temperatures: October 1957 to September 1960.
Sediment records: October 1957 to September 1960.

REVISED.—1956-60:
Sediment concentrations: Maximum daily, 78,000 mg/l Feb. 28; minimum daily, no flow for many days.
Sediment discharge: Maximum daily, 3,070,000 tons Feb. 28; minimum daily, 0 ton on many days.

Period of record:
Sediment concentrations: Maximum daily, 78,000 mg/l Feb. 28, 1960; minimum daily, no flow for many days.
Sediment discharge: Maximum daily, 3,070,000 tons Feb. 28, 1960; minimum daily, 0 ton on many days.

REMARKS.—No flow Oct. 1-30, Oct. 31 to Nov. 14, Nov. 17 to Dec. 10, 12-15, 17-18, 21-26, Dec. 27 to Jan. 13, 16-17, June 1 to Sept. 30.

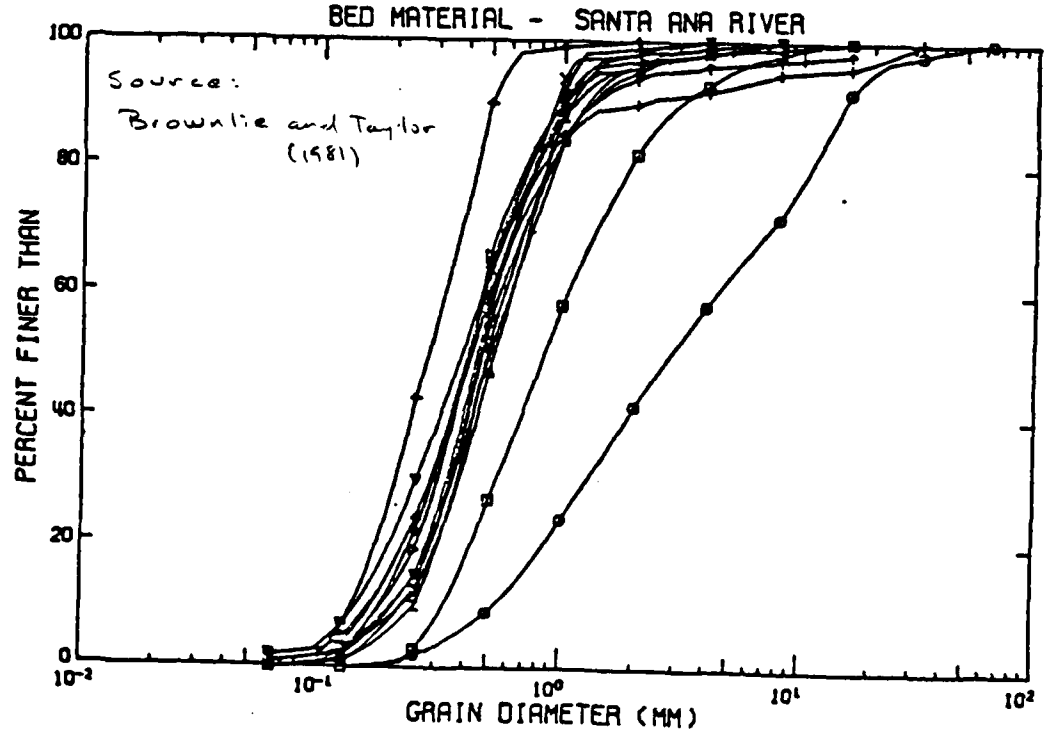
1969 SUSPENDED SEDIMENT SANTA ANA R.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1960 TO SEPTEMBER 1960
(METHODS OF ANALYSIS: B. DIPPOR WITHDRAWAL TUBE; C. CHEMICALLY DISPERSED; D. IN NATIVE WATER; P. PIPET; S. SIEVE; V. VISUAL ACCUMULATION TUBE; W. IN DISTILLED WATER)

DATE	TIME	WATER TEMPERATURE (°C)	DISCHARGE (CFS)	CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	METHOD OF ANALYSIS
JAN 14, 1960	0850	13	146	9000	3770	33	44	57	71	79	86	90	96	99	100	—	SPWC
JAN 19.....	1300	13	97	760	7*	50	56	66	80	84	90	96	100	—	—	—	SPWC
JAN 20.....	1049	—	372	6120	6190	39	38	50	66	72	81	91	100	—	—	—	SPWC
JAN 23.....	1324	—	931	5810	14700	23	25	30	35	39	44	53	66	86	100	100	SPWC
JAN 27.....	1419	—	9700	12000	1050000	14	19	25	34	44	54	70	86	98	100	—	SPWC
JAN 31.....	1930	—	2470	1130	7540	19	21	27	30	51	63	88	96	100	—	—	SPWC
FEB 11.....	1130	15	2710	6490	49000	11	12	16	22	28	37	66	71	93	100	—	SPWC
FEB 20.....	0600	12	9420	3140	80000	33	37	44	56	74	82	90	96	100	—	—	SPWC
FEB 25.....	1240	—	17000	2870	132000	26	31	39	52	69	76	88	96	100	—	—	SPWC
FEB 27.....	1219	14	6720	28100	510000	29	32	47	64	74	80	86	93	99	100	—	SPWC
MAY 6.....	1949	18	494	7400	32500	20	22	26	45	74	89	96	99	100	—	—	SPWC

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1960 TO SEPTEMBER 1960
(METHOD OF ANALYSIS: H. HYDROMETER; O. OPTICAL ANALYZER; S. SIEVE; V. VISUAL ACCUMULATION TUBE)

DATE	TIME	WATER TEMPERATURE (°C)	NUMBER OF SAMPLING POINTS	DISCHARGE (CFS)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) .062	.125	.250	.500	1.00	2.00	4.00	8.00	16.0	32.0	64.0	METHOD OF ANALYSIS
JAN 14, 1960	0835	13	2	120	—	3	10	66	90	96	98	99	100	—	—	S
JUN 6.....	—	—	4	0	2	5	24	65	89	94	96	97	98	98	100	S



Size-Distributions of Bed Material samples collected along the lower Santa Ana River during the past 10 years.

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968-71, 1973 to current year.
WATER TEMPERATURES: Water years 1968-71, 1973 to current year.
SEDIMENT RECORDS: Water years 1968-71, 1973 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1967 to September 1969, October 1970 to September 1971, October 1972 to September 1980, October 1981 to September 1982.
SEDIMENT RECORDS: October 1967 to September 1971, October 1972 to September 1980, October 1981 to September 1982.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean (water years 1968-71, 1973-80, 1982), 70,000 mg/L Feb. 25, 1969; minimum daily mean, no flow for many days each year.
SEDIMENT DISCHARGE: Maximum daily (water years 1968-71, 1973-80, 1982), 2,670,000 tons (2,420,000 metric tons) Feb. 25, 1969; minimum daily, 0 tons on many days each year.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 3,580 mg/L Apr. 2; minimum daily mean, no flow for many days.
SEDIMENT DISCHARGE: Maximum daily, 31,900 tons (28,900 metric tons) Apr. 2; minimum daily, 0 tons on many days.

SUMMARY OF WATER AND SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

MONTH	WATER DISCHARGE CFS-DAYS	SUSPENDED SEDIMENT DISCHARGE TONS	BEDLOAD DISCHARGE TONS	TOTAL SEDIMENT DISCHARGE TONS
OCTOBER 1981	9.22	108.00	0	108
NOVEMBER ...	257.70	284.00	318	602
DECEMBER ...	29.26	122.00	6	128
JANUARY 1982	247.18	530.00	161	691
FEBRUARY ...	282.05	810.00	313	1120
MARCH	3730.82	8113.00	7590	15700
APRIL	6446.69	7494.00	12400	19900
MAY	13.01	54.00	0	54
JUNE	4.51	52.00	0	52
JULY	0.25	3.00	0	3
AUGUST	0.0	0.0	0	0
SEPTEMBER ..	2.57	6.0	0	6
TOTAL	9023.26	17576.00	20788	38364

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	TEMPERATURE (DEG C)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
MAR									
15...	1100	16.0	119	30	--	--	--	--	--
17...	1020	11.5	2500	5000	61	75	88	95	99
18...	1230	14.5	1090	2360	44	54	64	71	--

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAR								
15...	94	--	98	--	98	100	--	--
17...	--	99	--	100	--	--	--	--
18...	74	--	74	--	74	84	99	100

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM
MAY									

11103000 LOS ANGELES RIVER AT LONG BEACH, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1973 to current year.
CHEMICAL ANALYSES: Water years 1973 to current year.
BIOLOGICAL DATA: Water years 1973-81.
SPECIFIC CONDUCTANCE: Water years 1974 to current year.
WATER TEMPERATURES: Water years 1974 to current year.
SEDIMENT RECORDS: Water years 1975 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1973 to September 1975, July 1980 to current year.
WATER TEMPERATURES: October 1973 to September 1975, January 1980 to current year.

INSTRUMENTATION.--Water-quality monitor recording specific conductance and water temperature October 1973 to September 1975 and since January 1980.

REMARKS.--Missing specific conductance and temperature data due to recorder malfunction.

EXTREMES FOR PERIOD OF RECORD.--
SPECIFIC CONDUCTANCE: Maximum recorded, 2,010 micromhos June 30, 1975; minimum recorded, 117 micromhos Mar. 6, 1975; minimum observed, 91 micromhos May 8, 1977.
WATER TEMPERATURES: Maximum recorded, 38.0°C June 24, 1981; minimum recorded, 2.0°C Jan. 31, 1975.

EXTREMES FOR CURRENT YEAR.--
SPECIFIC CONDUCTANCE: Maximum recorded, 1,880 micromhos July 6; minimum recorded, 112 micromhos Jan. 1.
WATER TEMPERATURES: Maximum recorded, 37.0°C Aug. 21; minimum recorded, 2.5°C Jan. 8.

WATER QUALITY DATA, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM
JAN						
19...	1200	17.5	69	12	72	--
MAR						
03...	1300	24.0	90	11	67	--
MAY						
25...	1300	30.5	32	19	49	--
JUL						
14...	1230	32.5	42	181	99	100
SEP						
14...	1200	21.0	53	9	48	--

11048500 SAN DIEGO CREEK AT SAND CANYON AVENUE, NEAR IRVINE, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.
WATER TEMPERATURES: Water years 1972 to current year.
SEDIMENT RECORDS: Water years 1972 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: June 1972 to current year.
SEDIMENT RECORDS: June 1972 to current year.

REMARKS.--Gage moved to present site at Sand Canyon Ave on January 1977. Prior to October 1976 at site 1 mi (2 km) downstream. No gage from October 1976 to January 1977. Extremes unknown for 1977 water year due to missing record prior to Jan. 19, 1977.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 28,700 mg/L Feb. 16, 1980; minimum daily mean, no flow Dec. 25, 1972, Nov. 15-17, 1973, Jan. 13, 1975.
SEDIMENT DISCHARGE: Maximum daily, 246,000 tons (223,000 metric tons) Feb. 16, 1980; minimum daily, 0 tons on several days most years.

EXTREMES FOR CURRENT YEAR.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 28,700 mg/L Feb. 16; minimum daily mean, 51 mg/L Nov. 16.
SEDIMENT DISCHARGE: Maximum daily, 246,000 tons (223,000 metric tons) Feb. 16; minimum daily, 0.40 tons (0.36 metric tons) Nov. 16.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM
OCT										
04...	--	56	--	--	--	--	--	--	--	--
23...	--	72	--	--	--	--	--	--	--	--
NOV										
13...	--	89	--	--	--	--	--	--	--	--
26...	--	95	--	--	--	--	--	--	--	--
DEC										
31...	--	78	--	--	--	--	--	--	--	--
JAN										
08...	32	--	36	--	57	--	96	--	100	--
09...	--	64	--	--	--	--	--	--	--	--
09...	53	--	71	--	89	--	99	--	100	--
09...	78	69	86	--	96	--	100	--	--	--
10...	--	94	--	--	--	--	--	--	--	--
11...	--	46	--	67	--	88	--	97	--	100
11...	--	58	--	78	--	91	--	98	--	100
11...	--	57	--	74	--	93	--	99	--	100
15...	--	98	--	--	--	--	--	--	--	--
17...	--	93	--	--	--	--	--	--	--	--
30...	--	63	--	--	--	--	--	--	--	--
31...	--	58	--	78	--	98	--	100	--	--
FEB										
21...	--	46	--	--	--	--	--	--	--	--
29...	--	97	--	--	--	--	--	--	--	--
MAR										
03...	--	74	--	--	--	--	--	--	--	--
18...	--	72	--	--	--	--	--	--	--	--
20...	--	64	--	--	--	--	--	--	--	--
27...	--	89	--	--	--	--	--	--	--	--
APR										
23...	--	85	--	95	--	100	--	--	--	--
JUL										
29...	--	78	--	--	--	--	--	--	--	--
SEP										
24...	--	40	--	--	--	--	--	--	--	--
29...	--	57	--	--	--	--	--	--	--	--

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM
SEP											
24...	1710	28.0	4	5.9	0	3	27	67	91	99	100

APPENDIX C

SOUTH CENTRAL REGION

1. Pertinent stream gages, South Central Region

2. Stream gages in San Luis Obispo County, from the San Luis Obispo County Flood Control and Water Conservation District

3. Stream gages in Ventura County, with location map, from Ventura County Flood Control and Water Resources Department

4. Descriptions of stream gages from U.S. Geological Survey publications

5. Debris Basins, Ventura County, with location map and typical data sheets from Ventura County Flood Control and Water Resources Department

6. Typical hydrographs during major storm events, South Central Region

7. Sediment size distribution, South Coast Region from U.S. Geological survey publications and Brownlie and Taylor (1981)

8. Fire Frequency Tables, from U.S. Forest Service, Los Padres National Forest. Courtesy of Bob Blecker and Fritz Cahill

1. Pertinent stream gages, South Central Region

REGION: SOUTH CENTRAL

STREAMS: SANTA CLARA RIVER, CALLEGUAS CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
Z2-11 45	11-1140.00	SANTA CLARA R.	USGS	34-14-31	R, F	1927	1932		1612	1930-1957
	11-1139.20			119-11-21		1949	PRESENT			MONTHLY ONLY
Z2-1300	11-1135.00	SANTA PAULA CR.	USGS	34-23-44	R	1927	1980		40.0	COMBINE
				119-04-32						
Z2-2150	11-1130.00	SESPE CR.	USGS	34-27-03	R	1911	PRESENT		251	
				118-55-30						
Z2-3150	11-1100.00	PIRU CR.	USGS	34-25-30	R	1911-	1974		437	
	(11-1098.00)			118-45-12		(1955)	PRESENT		(424)	
Z3-1380	11-1080.00	SANTA CLARA R.	USGS	34-25-30	R	1929	1950		411	
				118-35-12						
Z3-1135	11-1065.00	SANTA CLARA R.	USGS	34-23-59	R	1952	PRESENT		625	
				118-42-12						
Z4-1080	11-1055.5	CALLEGUAS CR.	USGS	34-10-46	R	1953	PRESENT		245	
			VC (805)	119-02-20						

R = RECORDING

F = DAILY FLOW

REGION:
SOUTH CENTRAL

STREAMS:
SANTA YNEZ MOUNTAINS GROUP

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA MI²	REMARKS
D9-5030	11-1208.00	CAÑADA HONDA	USGS	34-36-00 120-34-25	R	1959	1962		8.5	
D9-4050	11-1206.00	JALAMA CR.	USGS	34-30-48 120-29-00	R	1966	PRESENT		20.5	
D9-5710	11-1205.50	GAVIOTA CR.	USGS	34-29-16 120-13-34	R	1966			18.8	
D9-6520	11-1205.30	TECOLOTITO CR.	USGS	34-26-05 119-52-04	R	1962			4.4	
09-3040	11-1205.10	SAN JOSE CR.	USGS	34-25-49 119-49-16	R	1965			9.4	
D9-3100	11-1205.00	SAN JOSE CR.	USGS	34-27-33 119-48-29	R	1941			5.5	
D9-2100	11-1200.00	ATASCADERO CR.	USGS	34-25-29 119-48-39	R	1941			18.9	
D9-2550	11-1199.40	MARIA YGNACIO CR.	USGS	34-26-42 119-48-10	R	1968	PRESENT		6.4	
D9-2125	11-1199.50	MARIA YGNACIO CR.	SBAC	34-26-06 119-48-24	R	1959	1962		11.7	
D9-6410	11-1197.80	ARROYO BURRO	USGS	34-26-13 119-44-44	R	1967	PRESENT		6.65	
D9-6350	11-1197.50	MISSION CR.	USGS	34-25-35 119-43-20	R	1955	PRESENT		21.7	1955-1970, SANTA BARBARA Co.
D9-6300	11-1197.00	SYCAMORE CR.	USGS	34-25-42 119-40-36	R	1957	1962		3.4	1957-1970 SBAC :

R = RECORDING
F = DAILY FLOW

REGION:
SOUTH CENTRAL

STREAMS:
SANTA YNEZ MOUNTAINS GROUP [CONT..], VENTURA R.

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA mi^2	REMARKS
D9-6175	11-1195.40	SANTA MONICA CR.	USGS	34-25-06 119-31-34	R	1969	1978		3.6	
D9-6250	11-1196.60	SAN YSIDRO CR.	USGS	34-26-46 119-37-17	R,F	1971	PRESENT		3.1	1972-79 YEARLY MAX ONLY
D9-1100	11-1195.00	CARPENTERIA CR.	USGS	34-24-04 119-29-08	R	1941	PRESENT	1977	13.1	
D96155	11-1195.30	FRANKLIN CR.	USGS	34-24-15 119-31-05	R	1962	1978		1.8	
D9-6160	—	FRANKLIN CR.	SBAC	34-24-18 119-31-00	F	1962	1978		9.6	
Z1-1100.00	11-1185.00	VENTURA R.	USGS	34-21-08 119-18-27	R	1911 1929	1914		188	
Z2-1040	—	ARUNDELL BARRANCA	VC	34-15-12 119-15-48	R	1968	PRESENT		11.3	

R = RECORDING

F = DAILY FLOW

REGION:
SOUTH CENTRAL

STREAMS:
SANTA YNEZ RIVER

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA $M;^2$	REMARKS
D8-1175	11-1335.00	SANTA YNEZ R. NR LOMPOC	USGS	34-38-42 120-25-48	R	1906 1925 1978	1918 1960 1980		790	
D8-1100	11-1350.00	SANTA YNEZ R. PINE CYN.	USGS	34-40-20 120-29-30	R	1941 1964	1946		844	
D8-1050	11-1355.00	SANTA YNEZ R. BARRIER NR SURF	USGS	34-41-18 120-35-06	R	1947	1965		894	
D8-1125	11-1345.00	SANTA YNEZ R. 13th STREET	USGS	34-40-06 120-28-29	R	1954	1975		820	

R = RECORDING
F = DAILY FLOW

REGION:
SOUTH CENTRAL

STREAMS:
ARROYO GRANDE, SANTA MARIA RIVER, SAN ANTONIO CREEK

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
D5_5100	11_1415.00	ARROYO GRANDE	USGS	35_07_28 120_34_05	R	1939	PRESENT		102.0	
D6_1100	11_1410.00	SANTA MARIA R. AT GUADALOPE	USGS	34_58_35 120_34_15	R	1940	PRESENT		1741.0	1940_41 MONTHLY ONLY
D6_1150	11_1409.00	SANTA MARIA R. NEAR SANTA MARIA	USGS	34_59_12 120_29_48	F	1903	1906		1710.0	
D6_2300	11_1385.00	SISQUOC R.	USGS	34_50_25 120_10_00	R	1929	PRESENT		281.0	COMBINE FOR 1929_33
D6_3100	11_1370.00	CUYAMA R.	USGS	35_00_42 120_16_42	R	1929	1962		903.0	
D6_4100	11_1380.00	HUASNA CR.	USGS	35_01_24 120_19_18	R	1929	1961		118.0	
D8_2200	11_1361.00	SAN ANTONIO CREEK NEAR CASMALIA	USGS	34_46_56 120_31_47	R	1955	PRESENT		135.0	
D8_2300	11_1360.00	SAN ANTONIO CREEK AT HARRIS	USGS	34_45_42 120_25_24	R	1941	1955		94.0	UPSTREAM, FOR EARLY RECORDS ONLY

R = RECORDING

F = DAILY FLOW

REGION:
SOUTH CENTRAL

STREAMS:
MORRO BAY GROUP

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	RECORD LENGTH STOP	RECORD LENGTH MISSING	AREA MI^2	REMARKS
D5-1020	11-1425.50	SAN CORPOFORO CREEK	SLOC (SC)	35-45-25 121-17-57	R	1977	1978		34.6	
D5-1100	11-1425.00	ARROYO DE LA CRUZ	SLOC (AC)	35-43-02 121-17-02	R	1950	PRESENT		41.2	
D5-1500	—	SAN SIMEON CREEK	SLOC (SS)	35-36-37 121-04-30	R	1970			22.9	
D5-2010	11-1422.50	SANTA ROSA CREEK AT CAMBRIA	SLOC (LR)	35-33-38 121-05-38	R	1952			46.9	
D5-2150	11-1422.00	SANTA ROSA CR. NEAR CAMBRIA	SLOC (UR)	35-34-35 120-59-50	R	1972			12.5	SECONDARY, FOR EARLY RECORDS
D5-3550	—	VILLA CREEK	SLOC (VI)	35-29-34 120-58-40	R	1970			9.5	
D5-4235	—	SAN LUIS OBISPO CREEK	SLOC (LL)	35-11-45 120-41-45	R	1970	PRESENT		67.7	
D5-6005	11-1421.00	TORO CR.	SLOC (TO)	35-25-06 120-52-00	R	1952	1954		28.6	
D5-6300	11-1420.80	MORRO CR.	SLOC (MO)	35-22-42 120-51-12	R	1970	1978		24.0	
D5-6400	11-1420.60	SAN BERNARDO CREEK	SLOC (SB)	35-23-12 120-46-18	R	1960	PRESENT	1966-1975	5.6	

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REGION:
SOUTH CENTRAL

STREAMS:
MORRO BAY GROUP (CONT'D)

DWR #	USGS #	STREAM	AGENCY	LATITUDE, LONGITUDE	GAGE TYPE*	RECORD LENGTH START	STOP	MISSING	AREA Mi²	REMARKS
D5-6430	—	CHORRO CR.	SLOC (CR)	35-21-11 120-47-16	R	1978	PRESENT		22.0	
D5-6550	—	LOS OSOS CR.	SLOC (LO)	35-18-22 120-48-38	R	1976	PRESENT		7.6	

R= RECORDING

F= DAILY FLOW

2. Stream gages in San Luis Obispo County, from the San Luis Obispo County Flood Control and Water Conservation District

List of SLO County Engineering Dept Stream Gages

STREAM GAGING STATIONS CURRENTLY OPERATED BY SAN LUIS OBISPO COUNTY

Station Name	Computer Code	TWN R S 40AC	Latitude ° ' "	Longitude ° ' "	Drainage Sq. Mile	Av Prec Inches	Gage Elev Feet	Rec Began	Rec End	Yrs
ARROYO DE LA CRUZ NR SAN SIMEON	AC	25S/06E-35H	35-43-02	121-17-02	41.2	33.7	22	Oct. 1950		
CHOLAME CR NR SHANDON	CL	26S/15E-02N	35-41-23	120-20-00	227	14.9	1,069	Oct. 1958		
CHORRO CR NR MORRO BAY	CR	30S/11E-03D	35-21-11	120-47-16	22.0	22.3	65	Nov. 1978		
LOS BERROS CR NR NIPOMO	LB	12N/35W-25A	35-05-17	120-30-32	15.0	17.6	312	Aug. 1968		
LOS OSOS CR NR LOS OSOS	LO	30S/11E-20A	35-18-22	120-48-38	7.6	21.0	80	Feb. 1976		
MORRO CR AT MORRO BAY	MO	29S/10E-25F	35-22-42	120-51-12	24.0	24.1	20	Oct. 1970		
SAN BERNARDO CR NR MORRO BAY	SB	29S/11E-23M	35-23-12	120-46-18	5.6	25.5	293	Oct. 1952 Sept. 1976	Oct. 1965	11
SAN CARPOFORO CR NR SAN SIMEON	SC	25S/06E-15J	35-45-25	121-17-57	34.6	35.2	70	Oct. 1977		
SAN LUIS OBISPO CR NR AVILA	LL	31S/12E-28L	35-11-45	120-41-45	67.7	21.1	39	Oct. 1970		
SAN LUIS OBISPO CR NR SAN LUIS OBISPO	UL	30S/13E-30D	35-17-41	120-37-44	5.27	27.1	364	Nov. 1973		
SAN SIMEON CR NR CAMBRIA	SS	27S/08E-02Q	35-36-37	121-04-30	22.9	36.4	100	Sept. 1970		
SANTA MARGARITA CR NR SANTA MARGARITA	SM	29S/13E-19M	35-23-05	120-37-30	9.6	32.0	1,025	Oct. 1960		
SANTA ROSA CR AT CAMBRIA	LR	27S/08E-27F	35-33-38	121-05-38	46.9	25.9	16	Dec. 1975		
SANTA ROSA CR NR CAMBRIA	UR	27S/09E-21H	35-34-35	120-59-50	12.5	35.3	264	Aug. 1957		
STENNER CR AT CAL POLY	ST	30S/12E-22C	35-18-24	120-40-33	5.5	24.1	290	Oct. 1970		
TORO CR NR MORRO BAY	TO	29S/10E-12D	35-25-31	120-51-33	14.0	28.6	40	Oct. 1970		
VILLA CR NEAR HARMONY	VI	28S/09E-23D	35-29-34	120-58-40	9.5	26.1	75	Sept. 1970		
YERBA BUENA CR AT SANTA MARGARITA	YB	29S/13E-20F	35-23-33	120-36-20	4.5	28.2	995	Oct. 1964		

Sample of Streamflow Printout

SAN LUIS OBISPO COUNTY ENGINEERING DEPARTMENT

DAILY DISCHARGE IN CUBIC FEET PER SECOND FOR SANTA ROSA CREEK AT CAMBRIA

FOR YEAR ENDING SEPTEMBER 1981

RUN DATE 01/26/82

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT
1	0.44	0.75	0.96	0.82	**	84.	124.	27.	2.3	1.1	0.89	0.68
2	0.38	0.82	1.1	0.82	**	24.	121.	24.	2.0	1.1	0.89	0.61
3	0.31	0.89	1.3	1.4	**	9.8	114.	20.	1.9	1.1	0.82	0.47
4	0.31	0.89	4.8	1.6	**	230.	106.	18.	1.9	1.1	0.61	0.47
5	0.38	0.89	1.7	1.4	**	185.	101.	13.	1.9	1.0	0.75	0.44
6	0.47	0.96	1.2	1.2	**	78.	99.	11.	1.7	1.0	0.61	0.61
7	0.68	0.96	1.0	1.1	**	32.	96.	10.0	1.7	1.0	0.47	0.44
8	0.75	0.96	0.89	1.1	**	14.	93.	7.6	1.7	1.0	0.61	0.54
9	0.75	0.96	0.82	1.0	**	9.2	89.	5.7	1.6	1.0	0.61	0.54
10	0.75	1.0	0.75	1.0	**	6.2	88.	4.8	1.6	1.0	0.61	0.44
11	0.75	0.96	0.75	1.0	13.	5.0	85.	3.9	1.6	1.0	0.68	0.44
12	0.82	0.96	0.75	1.0	7.3	3.9	81.	3.9	1.7	0.89	0.54	0.41
13	0.82	0.96	0.68	0.96	5.7	4.1	78.	3.9	1.6	0.82	0.54	0.35
14	0.75	0.96	0.68	0.82	4.8	4.1	77.	3.9	1.7	0.82	0.44	0.28
15	0.75	1.0	0.75	0.75	3.9	3.3	74.	3.9	1.6	0.82	0.44	0.29
16	0.75	0.96	0.75	0.68	3.5	2.9	72.	3.7	1.3	0.82	0.54	0.28
17	0.82	0.96	0.75	0.68	3.1	1.9	71.	3.3	1.3	0.89	0.54	0.28
18	0.82	0.82	0.75	0.54	2.7	10.0	77.	3.1	1.3	0.96	0.41	0.28
19	0.82	0.89	0.75	0.44	2.7	1786.	81.	3.1	1.3	0.96	0.47	0.28
20	0.75	0.96	0.82	0.44	2.4	369.	75.	2.5	1.2	0.96	0.44	0.25
21	0.82	0.96	0.82	0.44	2.0	1699.	71.	1.9	1.2	0.96	0.44	0.25
22	0.89	1.0	0.82	3.1	1.7	557.	68.	1.9	1.2	0.82	0.47	0.22
23	0.96	1.0	0.96	17.	1.7	333.	63.	2.3	1.3	0.61	0.68	0.22
24	0.96	1.0	0.96	3.5	2.0	264.	63.	2.5	1.2	0.68	0.82	0.22
25	1.0	0.96	0.96	2.0	3.1	247.	63.	2.5	1.2	0.61	0.75	0.22
26	1.1	0.96	0.96	1.4	3.5	238.	52.	2.5	1.2	0.61	0.75	0.22
27	1.0	0.89	0.96	106.	2.7	197.	42.	2.4	1.2	0.61	0.75	0.25
28	0.82	0.89	0.82	71.	5.3	174.	38.	2.4	1.2	0.68	0.61	0.28
29	0.82	0.89	0.82	181.		157.	31.	2.1	1.2	0.82	0.61	0.28
30	0.82	0.96	0.82	**		144.	27.	2.4	1.2	0.82	0.82	0.28
31	0.75		0.82	**		133.		2.4		0.82	0.82	
OTAL	23.01	28.02	31.67	404.19?	71.1 ?	7005.4	2320.	201.6	45.0	27.38	19.43	10.81
EAN	0.74	0.93	1.02	13.94?	3.9 ?	225.9	77.	6.5	1.5	0.88	0.63	0.36
C-FT	46.	56.	63.	802. ?	141. ?	13895.	4602.	400.	89.	54.	39.	21.

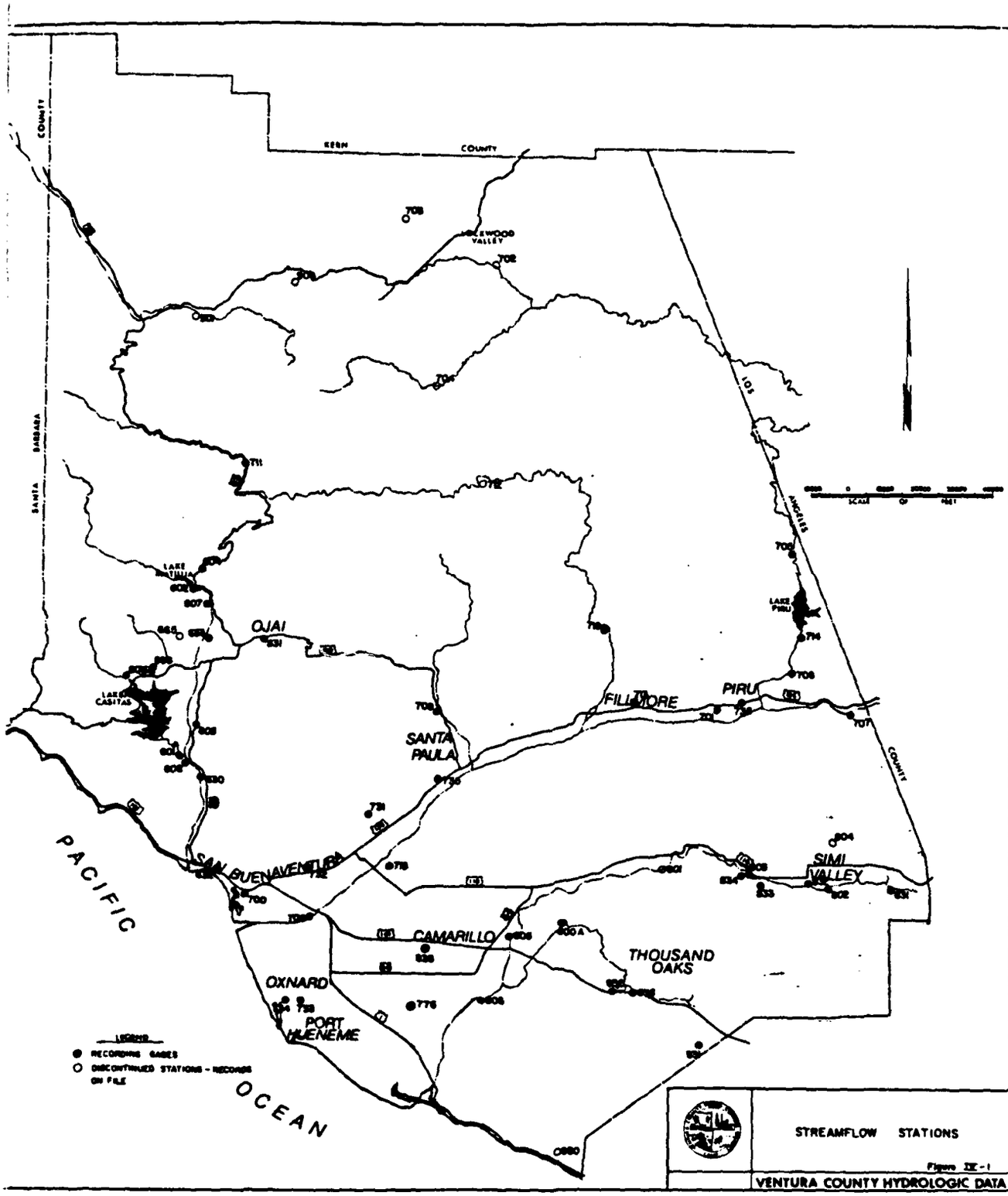
UM AF

NO OUTPUT PRINTED

** RECORD MISSING FOR THIS DATE
? ONE OR MORE DAYS OF RECORD MISSING

PEAK DISCHARGES (CFS)

DATE	TIME	G.H. (FT.)	DISCH. (CFS)
3-4-81	2000	5.67	1160
3-19-81	0930	9.26	5310
3-21-81	0750	6.30	1750
3-21-81	1915	8.55	4240


KERN COUNTY
SANTA BARBARA COUNTY
LOS ANGELES COUNTY
LAKE CASITAS
LAKE PIRU
OJAI
SANTA PAULA
FILLMORE
PIRU
SAN BUENAVENTURA
SIMI VALLEY
CAMARILLO
THOUSAND OAKS
OXNARD
PORT HUENEME
PACIFIC OCEAN
LEGEND
RECORDING GAGES
DISCONTINUED STATIONS - RECORDS ON FILE
STREAMFLOW STATIONS
Figure IX - 1
VENTURA COUNTY HYDROLOGIC DATA

3. Stream gages in Ventura County, with location map, from Ventura County Flood Control and Water Resources Department

TABLE IV-1 STREAMFLOW STATIONS
ALPHABETICAL INDEX

STATION NAME	STATION NUMBER	GAGE TYPE	RECORD BEGAN	OBSERVER	LOCATION OF DATA
Arroyo Conejo below Conejo Boulevard	836	BC	June 1976	VCFCD	BIENN
Arroyo Conejo South Branch above Ventu-Park Road	830	BC	Oct 1970	VCFCD	BIENN
Arroyo Simi at Moorpark	801	RG	1933	VCFCD	BIENN
Arroyo Simi at Royal Avenue	802	RG	Oct 1968	VCFCD	BIENN
Arroyo Simi near Simi	803	RG	1933	VCFCD	WSP
Arroyo Simi above White Oak Creek	831	BC	Dec 1970	VCFCD	BIENN
Arroyo Tapo below Los Angeles Avehue	832	BC	Oct 1969	VCFCD	BIENN
Arroyo Tapo above Walnut Avenue	804	RG	Oct 1971	VCFCD	BIENN
Arundell Barranca above Harbor Boulevard	700	RG	Oct 1963	VCFCD	BIENN
Bus Canyon Drain above Los Angeles Avenue	833	BC	Oct 1970	VCFCD	BIENN
Calleguas Creek at Camarillo State Hospital	805	RG	Oct 1955	VCFCD	WSP
Calleguas Creek above Highway 101	806	RG	Oct 1971	VCFCD	BIENN
Camarillo Hills Drain below Highway 101	835	BC	Jan 1976	VCFCD	BIENN

TYPE: BC - Bristol Crest
RD - Recording Digital
RG - Recording Graphic
WC - Witness Crest
T - Telemark

DATA: WSP - USGS Water-Supply Paper
BIENN - Biennial Report of Hydrologic Data
FILES - Files of the Water Resources Section

TABLE IV-1 STREAMFLOW STATIONS
ALPHABETICAL INDEX

STATION NAME	STATION NUMBER	GAGE TYPE	RECORD BEGAN	OBSERVER	LOCATION OF DATA
Canada Larga at Ventura Avenue	630	BC	Oct 1970	VCFCD	BIENN
Conejo Creek above Highway 101	800A	RGT	Oct 1968	VCFCD	WSP
Cooper Canyon Creek	665	RG	Sept 1979	VCFCD	FILES
Coyote Creek near Oak View	600	RD	Oct 1958	USGS	WSP
Coyote Creek near Ventura	601	RD	Oct 1927	USGS	WSP
Ellsworth Barranca at Foothill Road	731	BC	Oct 1970	VCFCD	BIENN
Fagan Canyon Drain below Harvard Boulevard	735	BC	Oct 1972	VCFCD	BIENN
Fox Barranca at Highway 118	808	RG	Oct 1971	VCFCD	BIENN
Fox Canyon Drain below Ojai Avenue	631	BC	Oct 1970	VCFCD	BIENN
Happy Valley Drain at Rice Road	633	BC	May 1974	VCFCD	BIENN
Harmon Barranca below Telegraph Road	732	BC	June 1971	VCFCD	BIENN
Hopper Creek near Piru	701	RG	Oct 1930	VCFCD	WSP
Little Sycamore Creek above Highway 1	930	BC	Oct 1969	VCFCD	BIENN
Lockwood Creek at Gorge near Stauffer	702	RD	Nov 1971	USGS/VCFCD	WSP

TYPE: BC - Bristol Cres RG - Recording Graphic T - Telemark
RD - Recording Digital WC - Witness Crest

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TABLE IV-1 STREAMFLOW STATIONS
ALPHABETICAL INDEX

STATION NAME	STATION NUMBER	GAGE TYPE	RECORD BEGAN	OBSERVER	LOCATION OF DATA
Matilija Creek at Matilija Hot Springs	602	RD	Oct 1927	USGS	WSP
Middle Fork Lockwood Creek near Stauffer	703	RD	Nov 1971	USGS/VCFCD	WSP
North Fork Matilija Creek at Matilija Hot Springs	604	RGT	Oct 1928	VCFCD	WSP
Oxnard West Drain above Bolker Street	733	BC	Oct 1970	VCFCD	BIENN
Oxnard West Drain at Wheelhouse Avenue	734A	BC	June 1974	VCFCD	BIENN
Piru Creek below Buck Creek, near Pyramid Lake	716		Oct 1976	USGS	WSP
Piru Creek above Lake Piru	705	RD	Oct 1955	USGS	WSP
Piru Creek below Santa Felicia Dam	714	RD	Oct 1955	USGS	WSP
Piru Creek below Thorn Meadows	704	RD	Nov 1971	USGS/VCFCD	WSP
Pole Creek at Sespe Avenue	713	RG	Mar 1974	VCFCD	BIENN
Potrero Creek below Westlake Boulevard	931	BC	Oct 1969	VCFCD	BIENN
Prince Barranca above Southern Pacific Railroad	632	BC	May 1973	VCFCD	BIENN
Real-Warring Drain above Pacific Avenue	736	BC	June 1974	VCFCD	BIENN

TYPE: BC Bristol Crest
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TABLE IV-1 STREAMFLOW STATIONS
ALPHABETICAL INDEX

STATION NAME	STATION NUMBER	GAGE TYPE	RECORD BEGAN	OBSERVER	LOCATION OF DATA
Revolon Slough at Laguna Road	776	RG	Oct 1979	VCFCD	BIENN
Reyes Creek near Ventucopa	901	RD	July 1972	USGS/VCFCD	WSP
San Antonio Creek at Casitas Springs	605	RG	Oct 1949	VCFCD	WSP
Santa Ana Creek near Oak View	606	RD	Oct 1958	USGS	WSP
Santa Clara River at Los Angeles-Ventura County Line	707	RDT	Oct 1952	USGS	WSP
Santa Clara River at Montalvo	708	RD	Oct 1927	USGS	WSP
Santa Paula Creek near Santa Paula	709	RD	Oct 1927	USGS	WSP
Saticoy Diversion near Saticoy	715	RG	Oct 1928	USGS/UWCD	WSP
Sespe Creek near Fillmore	710	RDT	Sept 1911	USGS	WSP
Sespe Creek West of Hot Springs Canyon	712	RG	Oct 1953	VCFCD	BIENN
Sespe Creek near Wheeler Springs	711	RG	Jan 1948	USGS	WSP
Station Canyon Creek	664	RG	Sept 1979	VCFCD	FILES
Sycamore Canyon Drain below Tierra Rejada Road	834	BC	Oct 1970	VCFCD	BIENN

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TABLE IV-1 STREAMFLOW STATIONS
ALPHABETICAL INDEX

STATION NAME	STATION NUMBER	GAGE TYPE	RECORD BEGAN	OBSERVER	LOCATION OF DATA
Ventura River near Meiners Oaks	607	RD	May 1959	USGS	WSP
Ventura River near Ventura	608	RD	Sept 1911	USGS	WSP
Wagon Road Creek near Stauffer	900	RD	June 1972	USGS/VCFCD	WSP

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TABLE IV-2 STREAMFLOW STATIONS
NUMERICAL INDEX

STATION NUMBER	STATION NAME
600	Coyote Creek near Oak View
601	Coyote Creek near Ventura
602	Matilija Creek at Matilija Hot Springs
604	North Fork Matilija Creek at Matilija Hot Springs
605	San Antonio Creek at Casita Springs
606	Santa Ana Creek near Oak View
607	Ventura River near Meiners Oaks
608	Ventura River near Ventura
630	Canada Larga at Ventura Avenue
631	Fox Canyon Drain below Ojai Avenue
632	Prince Barranca above Southern Pacific Railroad
633	Happy Valley Drain at Rice Road
664	Station Canyon Creek
665	Cooper Canyon Creek
700	Arundell Barranca above Harbor Boulevard
701	Hopper Creek near Piru
702	Lockwood Creek at Gorge near Stauffer
703	Middle Fork Lockwood Creek near Stauffer
704	Piru Creek below Thorn Meadows
705	Piru Creek above Lake Piru
707	Santa Clara River at Los Angeles-Ventura County Line
708	Santa Clara River at Montalvo
709	Santa Paula Creek near Santa Paula
710	Sespe Creek near Fillmore
711	Sespe Creek near Wheeler Springs
712	Sespe Creek West of Hot Springs Canyon
713	Pole Creek at Sespe Avenue
714	Piru Creek below Santa Felicia Dam
715	Saticoy Diversion near Saticoy
716	Piru Creek below Buck Creek, near Pyramid Lake
731	Ellsworth Barranca at Foothill Road
732	Harmon Barranca below Telegraph Road
733	Oxnard West Drain above Bolker Street
734A	Oxnard West Drain at Wheelhouse Avenue
735	Fagan Canyon Drain below Harvard Boulevard
736	Real-Warring Drain above Pacific Avenue
776	Revolon Slough at Laguna Road Bridge
800A	Conejo Creek above Highway 101
801	Arroyo Simi at Moorpark
802	Arrojo Simi at Royal Avenue
803	Arrojo Simi near Simi
804	Arroyo Tapo above Walnut Avenue
805	Calleguas Creek at Camarillo State Hospital
806	Calleguas Creek above Highway 101
808	Fox Barranca at Highway 118
830	Arrojo Conejo South Branch above Ventu-Park Road
831	Arrojo Simi above White Oak Creek
832	Arrojo Tapo below Los Angeles Avenue
833	Bus Canyon Drain above Los Angeles Avenue
834	Sycamore Canyon Drain below Tierra Rejada Road
835	Camarillo Hills Drain below Highway 101
836	Arrojo Conejo below Conejo Boulevard
900	Wagon Road Creek near Stauffer
901	Reyes Creek near Ventucopa
930	Little Sycamore Creek above Highway 1
931	Potrero Creek below Westlake Boulevard

4. Descriptions of stream gages from U.S. Geological Survey publications

SANTA CLARA RIVER BASIN

11114000 SANTA CLARA RIVER AT MONTALVO, CA

LOCATION.--Lat 34°14'31", long 119°11'21", in San Miguel Grant, Ventura County, Hydrologic Unit 18070102, on downstream end of center pier of southbound bridge on U.S. Highway 101, 0.9 mi (1.4 km) southeast of Montalvo, and 4.5 mi (7.2 km) upstream from mouth.

DRAINAGE AREA.--1,612 mi^2 (4,175 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1927 to September 1932, October 1949 to current year. Monthly discharge only for 1950-67, published in WRD 1968 report. October 1949 to September 1969, published as "at Saticoy."

GAGE.--Water-stage recorder. Datum of gage is 51.88 ft (15.813 m) National Geodetic Vertical Datum of 1929 (levels by Ventura County Flood Control District). Oct. 1, 1927, to Sept. 30, 1932, and Oct. 1, 1949, to Sept. 30, 1967, at same site at different datums. Oct. 1, 1967, to Feb. 2, 1970, at site 3.9 mi (6.3 km) upstream at different datum.

REMARKS.--Records poor. Flow partly regulated by Lake Piru (station 11109500) 33 mi (53 km) upstream since May 1955; by Pyramid Lake, capacity, 173,500 acre-ft (214 hm^3) 42 mi (68 km) 324,000 acre-ft (399 hm^3) 43 mi (69 km) upstream since January 1972. Natural flow affected by ground-water withdrawals, diversions, municipal use, and ground-water replenishment. Imported water from the California Water Project released to the basin at Castaic Dam and Pyramid Dam. Diversion to spreading grounds and for irrigation in Pleasant Valley, at site 6.0 mi (9.7 km) upstream (station 11113900). AVERAGE DISCHARGE represents flow to the ocean regardless of upstream development.

COOPERATION.--Three discharge measurements were furnished by Ventura County Flood Control District.

AVERAGE DISCHARGE.--38 years, 142 ft^3/s (4.021 m^3/s), 102,900 acre-ft/yr (127 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 165,000 ft^3/s (4,670 m^3/s) Jan. 25, 1969, gage height, 17.41 ft (5.307 m), present datum; no flow for long periods in most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Mar. 2, 1938, 120,000 ft^3/s (3,400 m^3/s), estimated by Ventura County Flood Control District.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,600 ft^3/s (244 m^3/s) Apr. 1, gage height, 5.85 ft (1.783 m); no flow for many days.

SANTA CLARA RIVER BASIN

11114000 SANTA CLARA RIVER AT MONTALVO, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968 to current year.
WATER TEMPERATURES: Water years 1968, 1969, 1971-81.
SEDIMENT RECORDS: Water years 1968 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1967 to September 1969, October 1970 to September 1981.
SEDIMENT RECORDS: October 1967 September 1981.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 108,000 mg/L Mar. 4, 1978; minimum daily mean, no flow for many days most years.
SEDIMENT DISCHARGE: Maximum daily, 20,400,000 tons (18,500,000 metric tons) Feb. 25, 1969; minimum daily, 0 tons on many days each year.

REMARKS.--Prior to October 1969, published as "at Saticoy" (station 11113920).

SUMMARY OF WATER AND SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

MONTH	WATER DISCHARGE CFS-DAYS	SUSPENDED SEDIMENT DISCHARGE TONS	BEDLOAD DISCHARGE TONS	TOTAL SEDIMENT DISCHARGE TONS
OCTOBER 1981	0.79	.03	0	0
NOVEMBER....	11.03	2.06	2	4
DECEMBER....	8.80	.59	0.5	1
JANUARY 1982	138.79	146.48	47	193
FEBRUARY....	30.85	7.07	5	12
MARCH.....	5263.39	35565.14	13195	48760
APRIL.....	10582.21	142625.23	43284	185900
MAY.....	44.55	5.64	6	12
JUNE.....	7.58	.37	.2	1
JULY.....	.95	0.	0	0
AUGUST.....	.16	0.	0	0
SEPTEMBER...	.24	.01	0	0
TOTAL...	16089.52	178352.59	56539.7	234883

SANTA CLARA RIVER BASIN

11114000 SANTA CLARA RIVER AT MONTALVO, CA

LOCATION.--Lat 34°14'31", long 119°11'21", in San Miguel Grant, Ventura County, Hydrologic Unit 18070102, on downstream end of center pier of southbound bridge on U.S. Highway 101, 0.9 mi (1.4 km) southeast of Montalvo, and 4.5 mi (7.2 km) upstream from mouth.

DRAINAGE AREA.--1,612 mi^2 (4,175 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1927 to September 1932, October 1949 to current year. Monthly discharge only for 1950-67, published in WRD 1968 report. October 1949 to September 1969, published as "at Saticoy."

GAGE.--Water-stage recorder. Datum of gage is 51.88 ft (15.813 m) National Geodetic Vertical Datum of 1929 (levels by Ventura County Flood Control District). Oct. 1, 1927, to Sept. 30, 1932, and Oct. 1, 1949, to Sept. 30, 1967, at same site at different datums. Oct. 1, 1967, to Feb. 2, 1970, at site 3.9 mi (6.3 km) upstream at different datum.

REMARKS.--Records poor. Flow partly regulated by Lake Piru (station 11109500) 33 mi (53 km) upstream since May 1955; by Pyramid Lake, capacity, 173,500 acre-ft (214 hm^3) 42 mi (68 km) 324,000 acre-ft (399 hm^3) 43 mi (69 km) upstream since January 1972. Natural flow affected by ground-water withdrawals, diversions, municipal use, and ground-water replenishment. Imported water from the California Water Project released to the basin at Castaic Dam and Pyramid Dam. Diversion to spreading grounds and for irrigation in Pleasant Valley, at site 6.0 mi (9.7 km) upstream (station 11113900). AVERAGE DISCHARGE represents flow to the ocean regardless of upstream development.

COOPERATION.--Three discharge measurements were furnished by Ventura County Flood Control District.

AVERAGE DISCHARGE.--38 years, 142 ft^3/s (4.021 m^3/s), 102,900 acre-ft/yr (127 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 165,000 ft^3/s (4,670 m^3/s) Jan. 25, 1969, gage height, 17.41 ft (5.307 m), present datum; no flow for long periods in most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Mar. 2, 1938, 120,000 ft^3/s (3,400 m^3/s), estimated by Ventura County Flood Control District.

CALLEGUAS CREEK BASIN

11106550 CALLEGUAS CREEK AT CAMARILLO STATE HOSPITAL, CA

LOCATION.--Lat 34°10'46", long 119°02'20", in Guadalasca Grant, Ventura County, Hydrologic Unit 18070103, on downstream side of county road bridge, 1.0 mi (1.6 km) northeast of Camarillo State Hospital, and 1.4 mi (2.3 km) downstream from Conejo Creek.

DRAINAGE AREA.--248 mi^2 (642 km^2).

PERIOD OF RECORD.--October 1968 to current year.

GAGE.--Water-stage recorder. Datum of gage is 58.42 ft (17.806 m) National Geodetic Vertical Datum of 1929 (levels by Ventura County Flood Control District).

REMARKS.--No regulation above station. Pumping for irrigation in valley 1.0 mi (1.6 km) above station. Sustained flow from city of Thousand Oaks reclamation plant.

COOPERATION.--Records were furnished by Ventura County Flood Control District and reviewed by Geological Survey.

AVERAGE DISCHARGE.--14 years, 35.5 ft^3/s (1.01 m^3/s), 25,790 acre-ft/yr (31.8 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 25,300 ft^3/s (716 m^3/s) Feb. 16, 1980, gage height, 10.54 ft (3.213 m), from rating curve extended above 4,600 ft^3/s (130 m^3/s) on basis of slope-conveyance study of maximum flow; no flow at times in some years.

VENTURA RIVER BASIN

11118500 VENTURA RIVER NEAR VENTURA, CA

LOCATION.--Lat 34°21'08", long 119°18'27", in southeast corner of Santa Ana Grant, Ventura County, Hydrologic Unit 18070101, on right bank 50 ft (15 m) downstream from bridge on Casitas Pass Road at Foster Memorial Park, 0.2 mi (0.3 km) downstream from Coyote Creek, and 5 mi (8 km) north of Ventura.

DRAINAGE AREA.--188 mi^2 (487 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1911 to January 1914, October 1929 to current year; combined records of river and diversion, October 1932 to current year.

GAGE.--Water-stage recorder on river; water-stage recorder and Parshall flume on diversion. Datum of gage is 205.23 ft (62.554 m) Ventura County Flood Control datum. See WSP 1315-B for history of changes prior to Nov. 2, 1949. Nov. 2, 1949, to June 12, 1969, at site 450 ft (137 m) downstream at datum 4.00 ft (1.219 m) lower.

REMARKS.--Records good. Flow partly regulated since March 1948 by Matilija Reservoir, usable capacity, 1,475 acre-ft (1.82 hm^3) and since October 1959 by Casitas Reservoir, capacity, 267,000 acre-ft (329 hm^3). Water diverted to Casitas Reservoir on Coyote Creek since January 1959. Diversion by city of Ventura for municipal supply began prior to 1911. AVERAGE DISCHARGE (River only) represents flow to ocean regardless of upstream development. For records of combined discharge of river and Ventura City diversion, see following page.

AVERAGE DISCHARGE.--River only: 55 years (water years 1912-13, 1930-82), 58.3 ft^3/s (1.651 m^3/s), 42,240 acre-ft/yr (52.1 hm^3/yr).
Combined river and diversion: 50 years, 67.8 ft^3/s (1.920 m^3/s), 49,120 acre-ft/yr (60.6 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--River only: Maximum discharge, 63,600 ft^3/s (1,800 m^3/s) Feb. 10, 1978, gage height, 19.14 ft (5.834 m), from rating curve extended above 34,000 ft^3/s (963 m^3/s); maximum gage height, 24.3 ft (7.41 m) Jan. 25, 1969, present datum, from floodmarks; no flow at times in many years.
Combined river and diversion: Maximum discharge, 63,600 ft^3/s (1,800 m^3/s) Feb. 10, 1978; no flow Nov. 28, 29, 1977, many days during 1982.

EXTREMES FOR CURRENT YEAR.--River only: Maximum discharge, 834 ft^3/s (23.6 m^3/s) Apr. 1, gage height, 4.06 ft (1.237 m); no flow many days October through December.
Combined river and diversion: Maximum discharge, 843 ft^3/s (23.9 m^3/s) Apr. 1; minimum daily, 0.62 ft^3/s (0.018 m^3/s) Jan. 31.

VENTURA RIVER BASIN

11118500 VENTURA RIVER NEAR VENTURA, CA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--December 1907 to December 1908, water years 1967 to current year.
CHEMICAL ANALYSES: December 1907 to December 1908, water years 1967-79.
WATER TEMPERATURES: Water years 1969, 1971-73, 1975-81 to current year.
SEDIMENT RECORDS: Water years 1969-73, 1975 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: October 1968 to September 1969, October 1970 to September 1973, October 1974 to September 1981.
SEDIMENT RECORDS: October 1968 to September 1973, October 1974 to September 1981.

REMARKS.--Surface-bed material particle sizes coarser than 16.0 mm were determined by particle count. Data is available in files of the Geological Survey.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SEDIMENT CONCENTRATIONS: Maximum daily mean, 32,000 mg/L (estimated) Jan. 25, 1969; minimum daily mean, no flow for many days most years.
SEDIMENT DISCHARGE: Maximum daily, 2,220,000 tons (2,010,000 metric tons), estimated, Jan. 25, 1969; minimum daily, 0 tons on many days most years.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

1185. Ventura River near Ventura, Calif.

Location.--Lat 34°21'05", long 119°18'23", in southeast corner of Santa Ana Grant, on right bank 500 ft downstream from county highway bridge at Foster Memorial Park, 0.2 mile downstream from Coyote Creek, and 5 miles north of Ventura, Ventura County.
Drainage area.--187 sq mi.
Records available.--September 1911 to January 1914, October 1929 to September 1960.
Gage.--Water-stage recorder. Altitude of gage is 200 ft (from topographic map). Prior to Jan. 18, 1914, chain gage at site 370 ft upstream at different datum (destroyed by flood). October 1929 to Nov. 2, 1949, at site 370 ft upstream at present datum.
Average discharge.--33 years (1911-13, 1929-60), 59.7 cfs (43,220 acre-ft per year); median of yearly mean discharges, 16 cfs (18,000 acre-ft per year). Average combined discharge of river and diversion, 28 years (1932-60), 70.8 cfs (51,200 acre-ft per year); median of yearly mean combined discharges, 29 cfs (21,000 acre-ft per year).
Extremes.--1911-13, 1929-60: Maximum discharge, 39,200 cfs Mar. 2, 1938 (gage height, [illegible] ft), from rating curve extended above 7,700 cfs on basis of slope-area and contracted-opening measurement of peak flow; no flow at times in many years.
Remarks.--Flow partly regulated by Matilija Reservoir since Mar. 14, 1948 (see p. 145) and by Casitas Reservoir since Oct. [illegible], 1959. Water diverted through pipeline at dam (Matilija Reservoir) to Ojai Valley for irrigation since May 1951. Water diverted to Casitas Reservoir since January 1959. City of Ventura diverts water above station for municipal supply. Extremes and first two tables hereunder show flow past station only. Third table shows flow past station combined with diversion by City of Ventura.

VENTURA RIVER BASIN

11118500 VENTURA RIVER NEAR VENTURA, CA

LOCATION.--Lat 34°21'08", long 119°18'27", in southeast corner of Santa Ana Grant, Ventura County, Hydrologic Unit 18070101, on right bank 50 ft (15 m) downstream from bridge on Casitas Pass Road at Foster Memorial Park, 0.2 mi (0.3 km) downstream from Coyote Creek, and 5 mi (8 km) north of Ventura.

DRAINAGE AREA.--188 mi^2 (487 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1911 to January 1914, October 1929 to current year; combined records of river and diversion, October 1932 to current year.

GAGE.--Water-stage recorder on river; water-stage recorder and Parshall flume on diversion. Datum of gage is 205.23 ft (62.554 m) Ventura County Flood Control datum. See WSP 1315-B for history of changes prior to Nov. 2, 1949. Nov. 2, 1949, to June 12, 1969, at site 450 ft (137 m) downstream at datum 4.00 ft (1.219 m) lower.

REMARKS.--Records good. Flow partly regulated since March 1948 by Matilija Reservoir, usable capacity, 1,473 acre-ft (1.82 hm^3) and since October 1959 by Casitas Reservoir, capacity, 267,000 acre-ft (329 hm^3). Water diverted to Casitas Reservoir on Coyote Creek since January 1959. Diversion by city of Ventura for municipal supply began prior to 1911. AVERAGE DISCHARGE (River only) represents flow to ocean regardless of upstream development. For records of combined discharge of river and Ventura City diversion, see following page.

AVERAGE DISCHARGE.--River only: 55 years (water years 1912-13, 1930-82), 58.3 ft^3/s (1.651 m^3/s), 42,240 acre-ft/yr (52.1 hm^3/yr).
Combined river and diversion: 50 years, 67.8 ft^3/s (1.920 m^3/s), 49,120 acre-ft/yr (60.6 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--River only: Maximum discharge, 63,600 ft^3/s (1,800 m^3/s) Feb. 10, 1978, gage height, 19.14 ft (5.834 m), from rating curve extended above 34,000 ft^3/s (963 m^3/s); maximum gage height, 24.3 ft (7.41 m) Jan. 25, 1969, present datum, from floodmarks; no flow at times in many years.
Combined river and diversion: Maximum discharge, 63,600 ft^3/s (1,800 m^3/s) Feb. 10, 1978; no flow Nov. 28, 29, 1977, many days during 1982.

EXTREMES FOR CURRENT YEAR.--River only: Maximum discharge, 834 ft^3/s (23.6 m^3/s) Apr. 1, gage height, 4.06 ft (1.237 m); no flow many days October through December.
Combined river and diversion: Maximum discharge, 843 ft^3/s (23.9 m^3/s) Apr. 1; minimum daily, 0.62 ft^3/s (0.018 m^3/s) Jan. 31.

CARPINTERIA CREEK BASIN

11119500 CARPINTERIA CREEK NEAR CARPINTERIA, CA

LOCATION.--Lat 34°24'05", long 119°29'08", in El Rincon Grant, Santa Barbara County, Hydrologic Unit 18060013, on right bank 100 ft (30 m) upstream of bridge on State Highway 192, 165 ft (50 m) downstream from Gobernador Creek, and 1.8 mi (2.9 km) northeast of Carpinteria.

DRAINAGE AREA.--13.1 mi^2 (33.9 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1941 to September 1977, October 1978 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 130 ft (40 m), from topographic map. Prior to July 1, 1958, at site 100 ft (30 m) downstream, at datum 6.00 ft (1.829 m) higher. July 2, 1958, to Aug. 27, 1970, at site 65 ft (20 m) downstream at datum 4.00 ft (1.219 m) higher. Aug. 28, 1970, to Sept. 30, 1977, at site 100 ft (30 m) downstream at same datum.

REMARKS.--Records fair. No regulation above station. Gobernador Land and Water Co. diverts from Gobernador Creek 1.8 mi (2.9 km) above station. Small lake 0.8 mi (1.3 km) southeast of station and outside the drainage area stores storm runoff and surplus water diverted by Gobernador Land and Water Co. from Gobernador Creek. At times this lake is drained by pumping water back into Gobernador Creek 1,000 ft (305 m) above station.

AVERAGE DISCHARGE.--40 years (water years 1941-77, 1979-82), 2.87 ft^3/s (0.081 m^3/s), 2,080 acre-ft/yr (2.56 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,880 ft^3/s (251 m^3/s) Dec. 27, 1971, gage height, 14.10 ft (4.298 m), from floodmark, from rating curve extended above 150 ft^3/s (3.68 m^3/s) on basis of slope-area measurement of maximum flow; no flow at times in each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 334 ft^3/s (9.46 m^3/s) Apr. 1 (0330 hrs), gage height, 5.23 ft (1.594 m); no other peak above base of 125 ft^3/s (3.54 m^3/s); minimum daily, no flow for several months.

SAN YSIDRO CREEK BASIN

11119660 SAN YSIDRO CREEK AT MONTECITO, CA

LOCATION.--Lat 34°27'00", long 119°37'19", in Pueblo Lands of Santa Barbara, Santa Barbara County, Hydrologic Unit 18060013, on left bank 150 ft (46 m) downstream from debris basin, and 0.8 mi (1.3 km) north-northeast of intersection of San Ysidro and East Valley Roads, in Montecito.

DRAINAGE AREA.--3.07 mi^2 (7.95 km^2).

PERIOD OF RECORD.--1969, 1972-79 (yearly maximum discharge only), October 1979 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 570 ft (174 m), from topographic map.

REMARKS.--Records fair. Debris basin may at times affect peak flows.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,620 ft^3/s (159 m^3/s), Jan. 25, 1969, from slope-area measurement of maximum flow; minimum daily, 0.09 ft^3/s (0.003 m^3/s) Sept. 5, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 27 ft^3/s (0.76 m^3/s) Apr. 1 (0215 hrs), gage height, 1.17 ft (0.357 m), no other peak above base of 20 ft^3/s (0.57 m^3/s); minimum daily, 0.09 ft^3/s (0.003 m^3/s) Sept. 5.

MISSION CREEK BASIN

11119750 MISSION CREEK NEAR MISSION STREET, AT SANTA BARBARA, CA

LOCATION.--Lat 34°25'35", long 119°43'20", in Pueblo Lands of Santa Barbara, Santa Barbara County, Hydrologic Unit 18060013, on left bank just south of end of Los Olivos Street in Santa Barbara.

DRAINAGE AREA.--8.38 mi^2 (21.70 km^2).

PERIOD OF RECORD.--October 1970 to current year.

GAGE.--Water-stage recorder. Concrete-lined channel. Altitude of gage is 105 ft (32 m), from topographic map.

REMARKS.--Records fair. No regulation or diversion above station. Water at times released to creek for ground-water recharge from Gibraltar tunnel, several miles upstream.

AVERAGE DISCHARGE.--12 years, 3.16 ft^3/s (0.089 m^3/s), 2,290 acre-ft/yr (2.82 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,580 ft^3/s (73.1 m^3/s) Jan. 18, 1973, gage height, 4.97 ft (1.515 m), from rating curve extended above 41 ft^3/s (1.16 m^3/s) on basis of computation of flow in concrete-lined channel; maximum gage height, 5.45 ft (1.661 m) Feb. 16, 1980; no flow most of each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 186 ft^3/s (5.27 m^3/s) Mar. 14, gage height, 2.74 ft (0.835 m), no peak above base of 200 ft^3/s (5.66 m^3/s); minimum daily, no flow for several months.

ARROYO BURRO CREEK BASIN

11119780 ARROYO BURRO CREEK AT SANTA BARBARA, CA

LOCATION.--Lat 34°26'13", long 119°44'44", in Pueblo Lands of Santa Barbara, Santa Barbara County, Hydrologic Unit 18060013, on right bank 0.4 mi (0.6 km) south of State Street on Hope Avenue in Santa Barbara.

DRAINAGE AREA.--6.65 mi^2 (17.22 km^2).

PERIOD OF RECORD.--October 1970 to current year.

REVISED RECORDS.--WDR CA-76-1: 1974, 1975 (M).

GAGE.--Water-stage recorder. Concrete-lined channel with a low-water control. Altitude of gage is 160 ft (49 m), from topographic map.

REMARKS.--Records good except those below 1.0 ft^3/s (0.028 m^3/s), which are poor. Small amount of inflow occurs at times from large shopping center that empties water directly into the stream. Partial regulation by Lauro Canyon Reservoir on San Roque Creek.

AVERAGE DISCHARGE.--12 years, 2.44 ft^3/s (0.069 m^3/s), 1,770 acre-ft/yr (2.18 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,850 ft^3/s (52.4 m^3/s) Mar. 4, 1978, Feb. 16, 1980, from rating curve extended above 50 ft^3/s (1.42 m^3/s) on basis of computation of flow in trapezoidal section; maximum gage height, 5.67 ft (1.728 m) Mar. 4, 1978; no flow many days in each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 137 ft^3/s (3.88 m^3/s) Mar. 16 (0815 hrs), gage height, 2.59 ft (0.789 m) from rating curve extended above 62 ft^3/s (1.76 m^3/s) on basis of computation of flow in trapezoidal channel; no peak above base of 300 ft^3/s (8.50 m^3/s); no flow many days.

SAN JOSE CREEK BASIN

11120500 SAN JOSE CREEK NEAR GOLETA, CA

LOCATION.--Lat 34°27'33", long 119°48'29", in La Goleta Grant, Santa Barbara County, Hydrologic Unit 18060013, on right bank, 1.1 mi (1.8 km) downstream from unnamed tributary, and 1.7 mi (2.7 km) northeast of Goleta.

DRAINAGE AREA.--5.51 mi^2 (14.27 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1941 to current year.

GAGE.--Water-stage recorder and concrete low-water control. Datum of gage is 95.61 ft (29.142 m) Santa Barbara County Road Department datum. Prior to Dec. 24, 1955, at datum 5.50 ft (1.676 m) higher. Dec. 24, 1955, to Jan. 10, 1960, at datum 1.5 ft (0.46 m) higher. Prior to Oct. 1, 1971, at site 75 ft (23 m) downstream at same datum.

REMARKS.--Records fair except those below 1.0 ft^3/s (0.028 m^3/s), which are poor. No regulation above station. Many small diversions for irrigation above station.

AVERAGE DISCHARGE.--41 years, 1.96 ft^3/s (0.056 m^3/s), 1,420 acre-ft/yr (1.75 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,000 ft^3/s (56.6 m^3/s) Jan. 25, 1969, gage height, 10.10 ft (3.078 m), from rating curve extended above 400 ft^3/s (11.3 m^3/s) on basis of slope-area measurement at gage height 9.32 ft (2.841 m); maximum gage height, 12.74 ft (3.883 m), present datum, Jan. 21, 1943; no flow at times in most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 267 ft^3/s (7.56 m^3/s) Apr. 1 (0115 hrs), gage height 5.00 ft (1.524 m) from rating curve extended above 40 ft^3/s (1.13 m^3/s) on basis of theoretical computation of peak flow, no other peak above base of 100 ft^3/s (2.83 m^3/s); minimum daily, 0.03 ft^3/s (0.001 m^3/s) many days during year.

SAN JOSE CREEK BASIN

11120510 SAN JOSE CREEK AT GOLETA, CA

LOCATION.--Lat 34°25'49", long 119°49'16", in La Goleta Grant, Santa Barbara County, Hydrologic Unit 18060013, on right bank south of Hollister Avenue on Kellogg Avenue, 0.5 mi (0.8 km) southeast of Goleta.

DRAINAGE AREA.--9.42 mi^2 (24.40 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1970 to current year.

REVISED RECORDS.--WDR CA-73-1: 1973(M).

GAGE.--Water-stage recorder and concrete channel. Altitude of gage is 10 ft (3 m), from topographic map.

REMARKS.--Records fair. No regulation above station. Diversions for irrigation and domestic use above station.

AVERAGE DISCHARGE.--12 years, 2.84 ft^3/s (0.080 m^3/s), 2,060 acre-ft/yr (2.54 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,330 ft^3/s (66.0 m^3/s) Mar. 4, 1978, gage height, 5.65 ft (1.722 m), from rating curve extended above 400 ft^3/s (11.3 m^3/s) on basis of slope-conveyance computation of flow in concrete channel at gage height 8.00 ft (2.438 m); no flow for long periods in each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 373 ft^3/s (10.6 m^3/s) Apr. 1 (0145 hrs), gage height, 2.69 ft (0.820 m), from rating curve extended as explained above, no other peak above base of 250 ft^3/s (7.08 m^3/s); minimum, no flow many days.

ATASCADERO CREEK BASIN

11120000 ATASCADERO CREEK NEAR GOLETA, CA

LOCATION.--Lat 34°25'29", long 119°48'39", in La Goleta Grant, Santa Barbara County, Hydrologic Unit 18060013, on downstream side of center pier of county road bridge 100 ft (30 m) downstream from Maria Ygnacio Creek, 1.3 mi (2.1 km) upstream from mouth, and 1.3 mi (2.1 km) southeast of Goleta.

DRAINAGE AREA.--18.9 mi^2 (49.0 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1941 to current year. Prior to October 1947, published as Alascadero Creek near Goleta.

GAGE.--Water-stage recorder. Datum of gage is 8.59 ft (2.618 m) Santa Barbara County benchmark. Prior to Dec. 14, 1967, at site 275 ft (84 m) downstream, datum 4.00 ft (1.219 m) higher. Dec. 14, 1967, to Sept. 30, 1976, at datum 4.00 ft (1.219 m) higher and Oct. 1, 1976, to Sept. 30, 1978, at datum 2.00 ft (0.610 m) higher, both at present site.

REMARKS.--Records fair except those below 1.0 ft^3/s (0.028 m^3/s), which are poor. No regulation above station. Small diversions for irrigation above station. Some low flow results from return irrigation waste water.

AVERAGE DISCHARGE.--41 years, 4.65 ft^3/s (0.132 m^3/s), 3,370 acre-ft/yr (4.16 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,380 ft^3/s (152 m^3/s) Jan. 18, 1973, gage height, 13.1 ft (3.99 m) datum then in use, from rating curve extended above 2,300 ft^3/s (65.1 m^3/s); maximum gage height, 13.3 ft (4.05 m), from floodmark, Dec. 3, 1974, datum then in use; no flow some days in each year.

JALAMA CREEK BASIN

11120600 JALAMA CREEK NEAR LOMPOC, CA

LOCATION.--Lat 34°30'50", long 120°29'02", in San Julian Grant, Santa Barbara County, Hydrologic Unit 18060013, on downstream side of right bridge pier on Jalama Road, 0.6 mi (1.0 km) downstream from Gasper Creek, 1.4 mi (2.3 km) upstream from mouth, and 8.9 mi (14.3 km) southwest of Lompoc.

DRAINAGE AREA.--20.5 mi^2 (53.1 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1965 to September 1982 (discontinued).

GAGE.--Water-stage recorder and concrete control. Altitude of gage is 80 ft (24 m), from topographic map.

REMARKS.--Records good. No regulation or diversion above station. Some pumping upstream from wells for irrigation of about 400 acres (1.62 km^2).

AVERAGE DISCHARGE.--17 years, 3.67 ft^3/s (0.104 m^3/s), 2,660 acre-ft/yr (3.28 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,020 ft^3/s (114 m^3/s) Mar. 4, 1978, gage height, 11.34 ft (3.456 m), from rating curve extended above 1,700 ft^3/s (48.1 m^3/s) on basis of slope-area measurement at gage height 8.05 ft (2.454 m); no flow many days in most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 174 ft^3/s (4.93 m^3/s) Apr. 1 (0015 hrs), gage height 4.38 ft (1.335 m), no other peaks above base of 150 ft^3/s (4.25 m^3/s); minimum daily, 0.01 ft^3/s (<0.001 m^3/s) many days during August and September.

GAVIOTA CREEK BASIN

11120550 GAVIOTA CREEK NEAR GAVIOTA, CA

LOCATION.--Lat 34°29'16", long 120°13'34", in Nuestra Senora Del Refugio Grant, Santa Barbara County, Hydrologic Unit 18060013, on left bank 1.3 mi (2.1 km) northwest of Gaviota, and 1.6 mi (2.6 km) upstream from mouth.

DRAINAGE AREA.--18.8 mi^2 (48.7 km^2).

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder and concrete control. Altitude of gage is 100 ft (30 m), from topographic map.

REMARKS.--Records good. No regulation. Small pumping for domestic use.

AVERAGE DISCHARGE.--16 years, 5.95 ft^3/s (0.169 m^3/s), 4,310 acre-ft/yr (5.31 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,000 ft^3/s (113 m^3/s) Jan. 24, 1967, gage height, 8.40 ft (2.560 m), from rating curve extended above 1,300 ft^3/s (36.8 m^3/s) on basis of slope-area measurement of maximum flow; maximum gage height, 9.09 ft (2.771 m) Mar. 4, 1978; no flow at times in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 227 ft^3/s (6.43 m^3/s) Apr. 1, gage height, 3.94 ft (1.201 m), no peak above base of 300 ft^3/s (8.50 m^3/s); minimum daily, 0.06 ft^3/s (0.002 m^3/s) Sept. 3.

CARNEROS CREEK BASIN

11120530 TECOLOTITO CREEK NEAR GOLETA, CA

LOCATION.--Lat 34°26'05", long 119°52'04", in Los Dos Pueblos Grant, Santa Barbara County Hydrologic Unit 18060013, on right bank 0.2 mi (0.3 km) east of Glen Annie Road, and 2.1 mi (3.4 km) west of Goleta.

DRAINAGE AREA.--4.42 mi^2 (11.45 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1970 to September 1972, January 1980 to September 1982 (discontinued).

GAGE.--Water-stage recorder and concrete channel. Altitude of gage is 40 ft (12.2 m), from topographic map. Prior to Jan. 25, 1980, at same site at different datum.

REMARKS.--Records fair. No regulation above station. Some pumping for irrigation and water is occasionally released to channel from Tecolote Tunnel.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,610 ft^3/s (45.6 m^3/s) Feb. 16, 1980, gage height, 4.47 ft (1.362 m), from rating curve extended above 160 ft^3/s (4.53 m^3/s) on basis of slope-conveyance computation of flow in concrete channel; no flow at times in some years.

SANTA YNEZ RIVER BASIN

[illegible]. Santa Ynez River near Lompoc, Calif.

Location.--Lat 34°[illegible], long [illegible]25'40", near east boundary of La Mision Vieja de la Purisima Grant, on downstream end of center pier of bridge on State Highway 150, [illegible] miles east of Lompoc, Santa Barbara County, and [illegible] miles downstream from Salsipuedes Creek.

Drainage area.--[illegible] sq mi

Records available.--November to December 1906, October 1907 to September 1918, April 1925 to September [illegible]. Monthly discharge only for some periods, published in WSP 1315-B.

Gage.--Water-stage recorder. Datum of gage is [illegible] ft above mean sea level, datum of [illegible] [illegible], staff gage and Dec. 14, [illegible], to Nov. 30, 1959, water-stage recorder at site [illegible] ft upstream at various datums.

Extremes.--[illegible] Maximum discharge, [illegible] cfs Jan. [illegible], 19[illegible] (gage height, [illegible]), site and datum then in use, from discharge-mean depth study; [illegible] years.

Remarks.--[illegible] Lake and Gibraltar and Cachuma Reservoirs. Water [illegible] Lake and Gibraltar and Cachuma Reservoirs to cities [illegible] Santa Barbara, and Goleta for municipal supply. Some water pumped from [illegible] irrigation.

SANTA YNEZ RIVER BASIN

11135000 SANTA YNEZ RIVER AT PINE CANYON, NEAR LOMPOC, CA

LOCATION.--Lat 34°40'20", long 120°29'30", in Lompoc Grant, Santa Barbara County, Hydrologic Unit 18060010, on right bank at Floradale Avenue bridge, 2.1 mi (3.4 km) upstream from Santa Lucia Creek, 3 mi (5 km) northwest of Lompoc, and 7 mi (11 km) upstream from mouth at Pacific Ocean.

DRAINAGE AREA.--844 mi^2 (2,186 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1941 to October 1946, August 1964 to current year. Monthly discharge only for some periods, published in WSP 1315-B.

GAGE.--Water-stage recorder. Datum of gage is 40.78 ft (12.430 m) National Geodetic Vertical Datum of 1929. Prior to Aug. 24, 1964, at different datum. Aug. 24, 1964, to Aug. 20, 1970, at datum 0.91 ft (0.277 m) lower.

REMARKS.--Records fair. Flow regulated by Jameson Lake, Gibraltar Reservoir, and Lake Cachuma (stations 11121000, 11122000, 11125500). Water diverted out of basin from Jameson Lake, Gibraltar Reservoir, and Lake Cachuma to cities of Montecito, Santa Barbara, and Goleta for municipal supply. Water pumped from wells along bank for irrigation in valley upstream. Effluent from city of Lompoc contributes to low flow most months.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 78,000 ft^3/s (2,210 m^3/s), estimated, Jan. 25, 1969, gage height, 24.91 ft (7.593 m), present datum, from floodmark; no flow at times in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 710 ft^3/s (20.1 m^3/s), Apr. 1, gage height, 5.62 ft (1.713 m); minimum daily, 3.6 ft^3/s (0.10 m^3/s) Aug. 25-28.

SANTA YNEZ RIVER BASIN

11133000 SANTA YNEZ RIVER AT NARROWS, NEAR LOMPOC, CA

LOCATION (REVISED).--Lat 34°38'14", long 120°25'28", in Canada de Salsipuedes Grant, Santa Barbara County, on left bank 0.6 mi (1.0 km) upstream from State Highway 246, 1.9 mi (3.1 km) east of Lompoc, 1.8 mi (2.9 km) downstream from Salsipuedes Creek, and 12.4 mi (20.0 km) downstream from Lake Cachuma.

DRAINAGE AREA.--789 mi^2 (2,040 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1947 to November 1951 (irrigation seasons only). May 1952 to September 1963, October 1964 to September 1978, October 1980 to current year. Records equivalent, except for low-flow periods, to those published as "near Lompoc" (station 11133500), November to December 1906, October 1907 to September 1918, May 1925 to September 1960, October 1978 to September 1980.

GAGE.--Two water-stage recorders. Altitude of main gage is 90 ft (27 m) from topographic map. See WSP 1715 for history of changes prior to Oct. 1, 1961. Since Oct. 1, 1961, at various sites and datums within 0.1 mi (0.2 km) of present site. Supplementary gage, used for highwater periods, at site 0.6 mi (1.0 km) downstream at datum 79.25 ft (24.155 m) National Geodetic Vertical Datum of 1929.

REMARKS.--Records fair. Flow regulated by Jameson Lake, Gibraltar Reservoir, and since November 1952 by Lake Cachuma (stations 11121000, 11122000, 11125500). Water diverted out of Jameson Lake, Gibraltar Reservoir, and Lake Cachuma to cities of Montecito, Santa Barbara, and Goleta for municipal supply. Water pumped from wells along banks of river for irrigation in valley upstream.

EXTREMES FOR PERIOD OF RECORD (1952-63 and since 1964).--Maximum discharge, 80,000 ft^3/s (2,270 m^3/s) Jan. 25, 1969, gage height, 24.20 ft (7.376 m), from supplementary gage; no flow at times in each year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Jan. 9, 1907, 120,000 ft^3/s (3,400 m^3/s), gage height, 22.0 ft (6.71 m) site and datum then in use, from mean-depth study.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 593 ft^3/s (16.8 m^3/s) Apr. 1, gage height, 3.57 ft (1.088 m); no flow for several months.

SANTA MARIA RIVER BASIN

1410. Santa Maria River at Guadalupe, Calif.

Location.--Lat 34°58'35", long 120°34'15", in Guadalupe Grant, on downstream side of fifth bridge pier from left bank on State Highway 1, 0.5 mile north of Guadalupe, Santa Barbara County, and 4.5 miles upstream from mouth.

Drainage area.--1,763 sq mi.

Records available.--October 1940 to September 1960. Monthly discharge only for some periods, published in WSP 1315-B.

Gage.--Water-stage recorder. Datum of gage is 64.92 ft above mean sea level, datum of 1929, supplementary adjustment of 1934 (Corps of Engineers bench mark). Supplementary water-stage recorder near right bank at same datum, Jan. 19, 1941, to Aug. 11, 1955, at site 100 ft upstream at same datum, Oct. 5, 1945, to Aug. 11, 1955, supplementary gage near right bank 100 ft upstream at same datum.

Average discharge.--20 years (1940-60), 37.0 cfs (26,790 acre-ft per year); median of yearly mean discharges, 2.6 cfs (1,900 acre-ft per year).

Extremes.--1941-60: Maximum discharge, 32,800 cfs Jan. 16, 1952 (gage height, 8.18 ft); no flow for several months in each year.

Remarks.--Several small surface diversions and extensive pumpage from wells along stream for irrigation above station.

SANTA MARIA RIVER BASIN

11141000 SANTA MARIA RIVER AT GUADALUPE, CA

LOCATION.--Lat 34°58'35", long 120°34'15", in Guadalupe Grant, Santa Barbara County, Hydrologic Unit 18060008, on downstream side of bridge on State Highway 1, 0.5 mi (0.8 km) north of Guadalupe, and 4.5 mi (7.2 km) upstream from mouth.

DRAINAGE AREA.--1,741 mi^2 (4,509 km^2).

PERIOD OF RECORD.--October 1940 to current year. Monthly discharge only October 1940 to January 1941, published in WSP 1315-B.

GAGE.--Three water-stage recorders. Datum of main gage (left channel) is 64.92 ft (19.788 m) National Geodetic Vertical Datum of 1929. Two supplementary gages started in 1956 at various datums and locations. Prior to Aug. 11, 1955, main gage at site 100 ft (30 m) upstream at same datum NGVD.

REMARKS.--Records poor. Cuyama River regulated since February 1959 by Twitchell Reservoir, capacity, 240,000 acre-ft (296 hm^3). Several small surface diversions and extensive pumping from wells for irrigation along stream above station. AVERAGE DISCHARGE represents flow to ocean, regardless of upstream development.

AVERAGE DISCHARGE.--42 years, 28.2 ft^3/s (0.799 m^3/s), 20,430 acre-ft/yr (25.2 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 32,800 ft^3/s (929 m^3/s) Jan. 16, 1952, gage height, 8.18 ft (2.493 m); maximum gage height, 10.00 ft (3.048 m) Feb. 26, 1969; no flow for all or parts of each year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 301 ft^3/s (8.52 m^3/s) Apr. 12; gage height, 6.52 ft (1.987 m); no flow most of year.

SAN ANTONIO CREEK BASIN

11136100 SAN ANTONIO CREEK NEAR CASMALIA, CA

LOCATION.--Lat 34°46'56", long 120°31'47", in Jesus Maria Grant, Santa Barbara County, Hydrologic Unit 18060009, on Vandenberg Military Reservation on downstream side of center pile bent of San Antonio Road bridge, 0.7 mi (1.1 km) east of junction of San Antonio Road and Lompoc-Casmalia Road, and 3.8 mi (6.1 km) south of Casmalia.

DRAINAGE AREA.--135 mi^2 (350 km^2).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1955 to current year.

GAGE.--Water-stage recorder. Concrete control since August 1970. Altitude of gage is 160 ft (49 m), from topographic map. Prior to June 27, 1958, at datum 2.00 ft (0.610 m) higher.

REMARKS.--Records good. No regulation above station. Flow affected by pumping from wells along stream for irrigation above station. At times water released to creek from Vandenberg Air Force Base water-treatment plant.

AVERAGE DISCHARGE.--27 years, 5.51 ft^3/s (0.156 m^3/s), 3,990 acre-ft/yr (4.92 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,440 ft^3/s (97.4 m^3/s) Mar. 4, 1978, gage height, 13.22 ft (4.029 m), from rating curve extended above 1,100 ft^3/s (31.2 m^3/s) on basis of slope-area measurement at gage height 12.93 ft (3.941 m); minimum daily, 0.10 ft^3/s (0.003 m^3/s) June 19, 20, 1957.

ARROYO DE LA CRUZ BASIN

1426. Arroyo de la Cruz near San Simeon, Calif.

Location.--Lat 35°43'26", long 121°17'00", in Piedra Blanca Grant, on right bank 1.7 miles upstream from mouth and 7 miles northwest of town of San Simeon, San Luis Obispo County.

Drainage area.--41.4 sq mi.

Records available.--October 1960 to September 1980.

Gage.--Water-stage recorder. Altitude of gage is 22 ft (from topographic map).

Average discharge.--10 years (1960-80), 50.5 cfs (36,560 acre-ft per year); median of yearly mean discharges, 38 cfs (27,500 acre-ft per year).

Extremes.--1960-60: Maximum discharge, 17,700 cfs Dec. 23, 1966 (gage height, 12.40 ft), from rating curve extended above 7,000 cfs on basis of slope-area measurement of peak flow; no flow for several months in each year.

Remarks.--No regulation or diversion.

ARROYO GRANDE BASIN

1415. Arroyo Grande at Arroyo Grande, Calif.

Location.--Lat 35°07'30", long 120°34'05", in Pismo Grant, on left bank at Arroyo Grande, San Luis Obispo County, 0.7 mile upstream from U. S. Highway 101.

Drainage area.--106 sq mi.

Records available.--October 1939 to September 1980. Monthly discharge only for December 1939 and yearly estimate for water year 1940 (incomplete), published in WSP 1315-B.

Gage.--Water-stage recorder and broad-crested weir. Datum of gage is 97.77 ft above mean sea level, datum of 1929, supplementary adjustment of 1934. Prior to July 10, 1947, at datum 0.50 ft higher.

Average discharge.--21 years (1939-60), 21.5 cfs (15,570 acre-ft per year); median of yearly mean discharges, 9.4 cfs (6,800 acre-ft per year).

Extremes.--1939-60: Maximum discharge, 5,370 cfs Jan. 15, 1962 (gage height, 11.97 ft); no flow Sept. 4-8, 1960.

Remarks.--Many small and intermittent diversions by pumping from stream for irrigation above station.

5. Debris Basins, Ventura County, with location map and typical data sheets from Ventura County Flood Control and Water Resources Department

DEBRIS BASINS VENTURA CO.

ZONE I

DENT	**DB1-01**
STEWART CANYON	**DB1-02**

DEBRIS BASINS

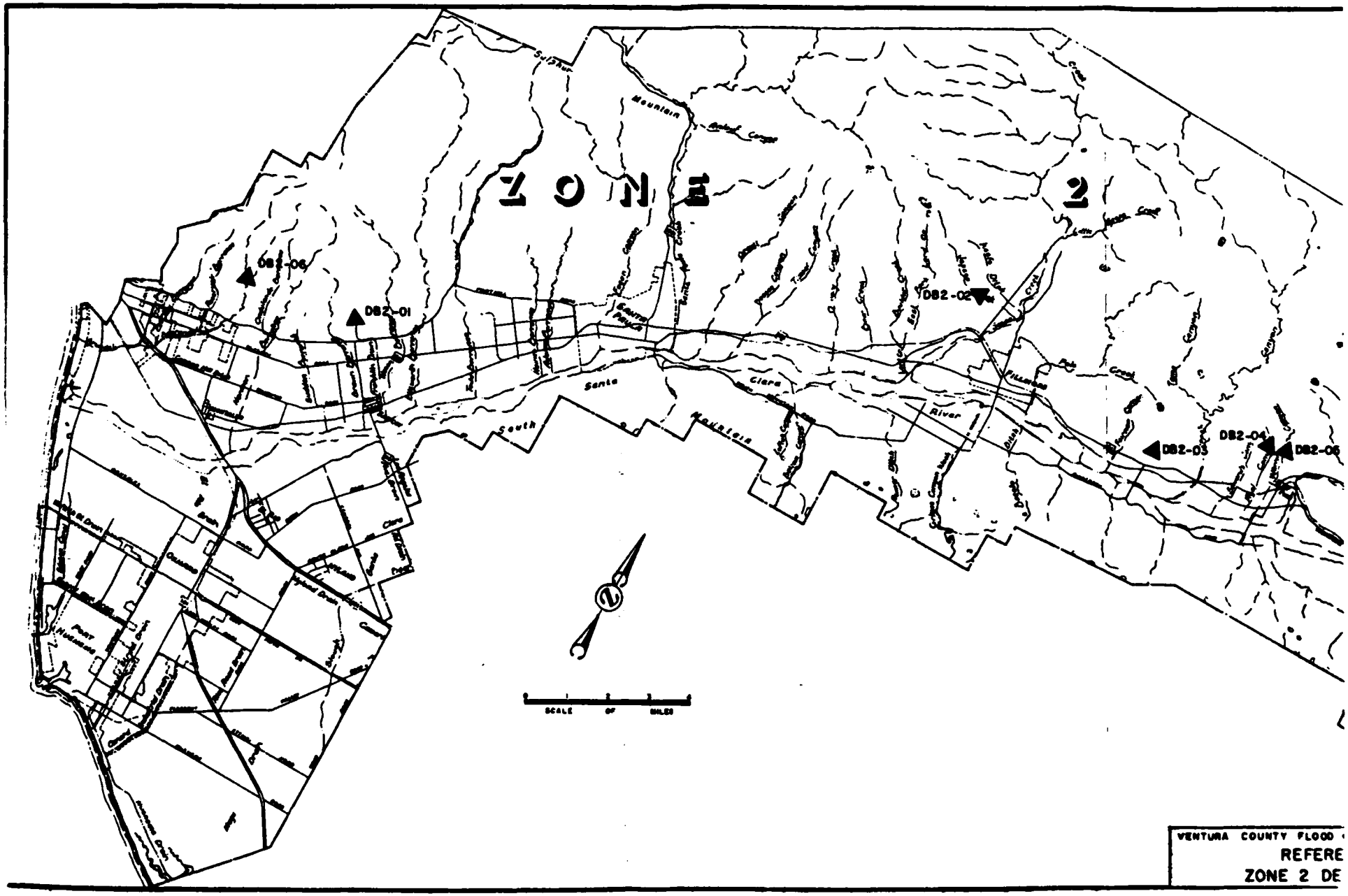
ZONE II

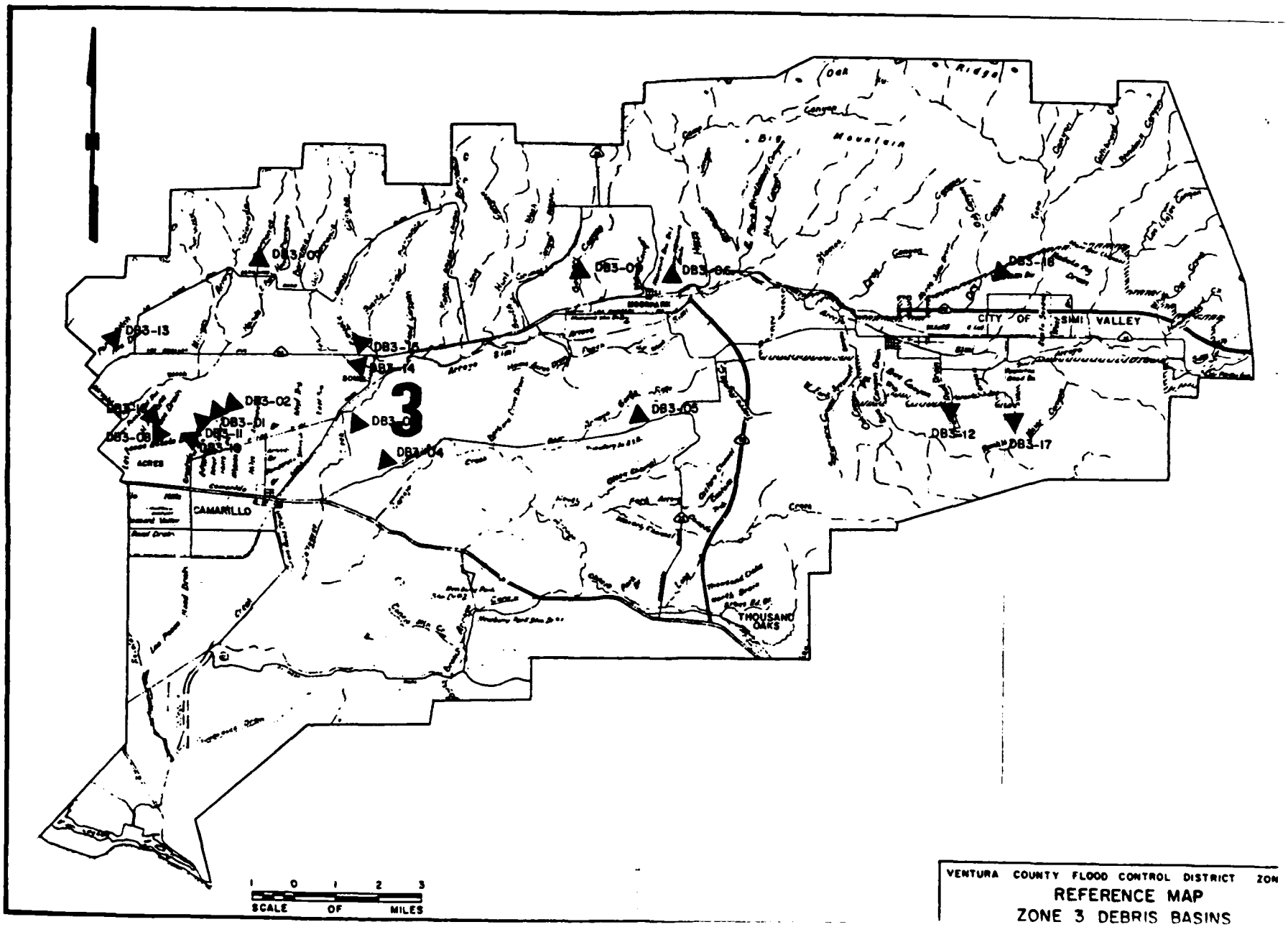
ARUNDELL BARRANCA	DB2-06
CAVIN ROAD	DB2-03
FRANKLIN BARRANCA	DB2-01
JEPSON WASH	DB2-02
REAL WASH	DB2-04
WARRING CANYON	DB2-05

DEBRIS BASINS VENTURA CO.
ZONE III

CASTRO-WILLIAMS	Moorpark	DB3-06
COYOTE CANYON	Camarillo	DB3-15
CRESTVIEW -	"	DB3-10
EDGEMORE	"	DB3-11
ERRINGER ROAD	Simi Vly	DB3-12
FERRO -	Camarillo/Rw.	DB3-13
FOX BARRANCA (SOMIS)	Camarillo	DB3-14
GABBERT CANYON -	Moorpark	DB3-09
HONDA WEST	Cam.	DB3-07
LAS POSAS ESTATES	Camarillo	DB3-08
RAMONA	"	DB3-16
RUNKLE CANYON	Simi Valley	DB3-17
SANTA ROSA ROAD NO. 1	Cam.	DB3-04
SANTA ROSA ROAD NO. 2	"	DB3-05
ST. JOHNS	Camarillo	DB3-03
TAPO HILLS NO. 1	Simi Vly	DB3-18
2		3-19
WEST CAMARILLO HILLS EAST BRANCH	Cam	DB3-02
WEST CAMARILLO HILLS WEST BRANCH	Cam	DB3-01
Sycamore Cyn Dam		FR-320
La. Llajas Cyn Dam		FR-321


1
DBI-02
DBI-01
Mountains
Santa
Castaic
Reservoir
OAK VIEW
1 0 1 2 3
SCALE OF MILES
VENTURA COUNTY FLOOD CONTROL DISTRICT
REFERENCE MAP
ZONE 1 DEBRIS BASINS


ZONE 2
DB2-06
DB2-01
DB2-02
DB2-03
DB2-04
DB2-05
Santa Clara River
South Mountain
SCALE OF MILES
VENTURA COUNTY FLOOD
REFERE
ZONE 2 DE



VENTURA COUNTY FLOOD CONTROL DISTRICT ZON

REFERENCE MAP

ZONE 3 DEBRIS BASINS

Typical Data Summary Sheet

GABBERT CANYON (DB3-09)

Expected Debris Production (cy):

	Design Conditions	100% Burn
100-Year	56,900	81,600
50-Year	42,700	61,200
25-Year	30,800	44,200

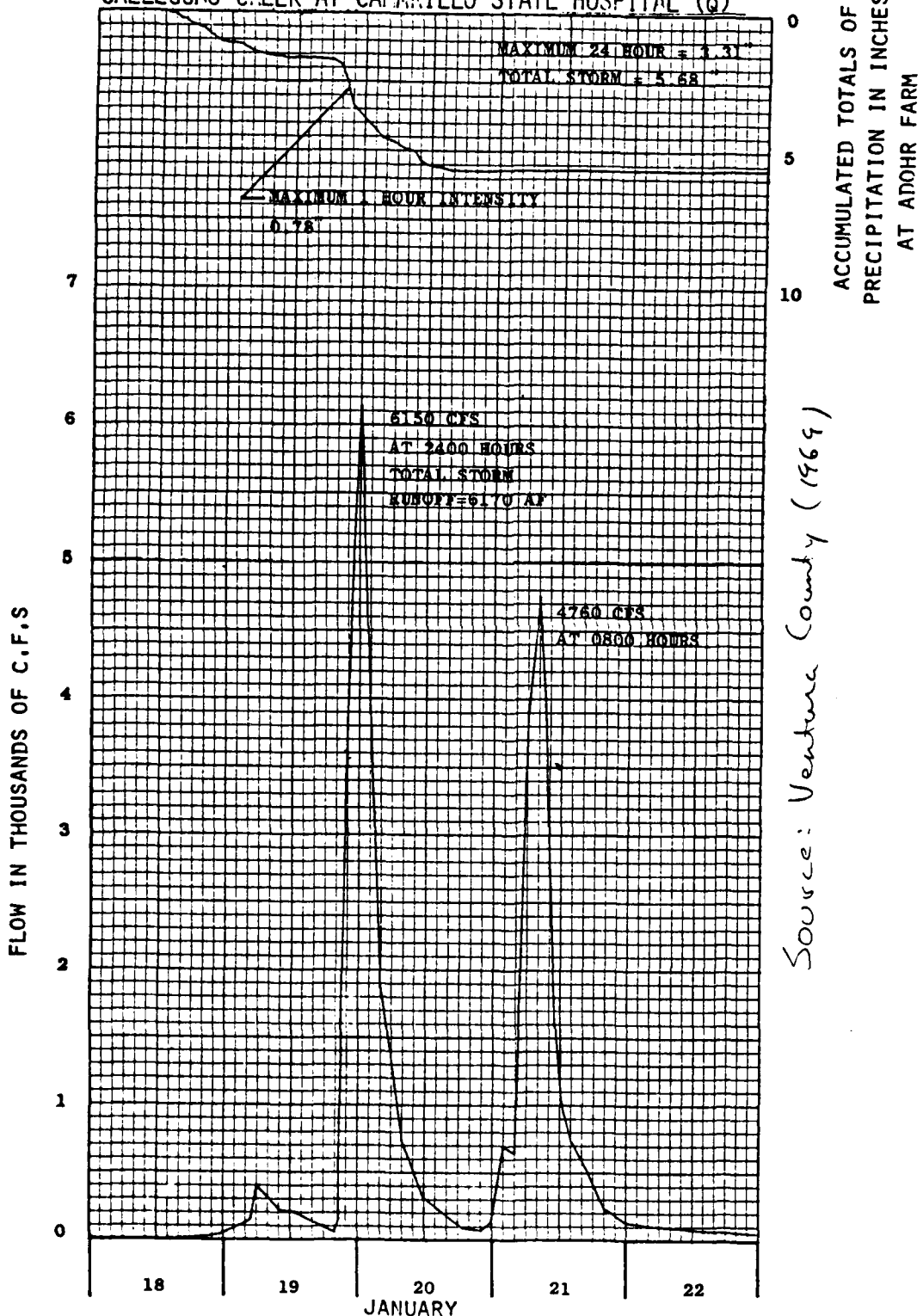
Cleanout	Date of: Aerial Survey	Capacity (cy)	Remarks
9-69			~25,000 cy removed.
	2-6-70	60,000	
	11-12-70	57,000	
	5-16-71	55,400	
9-71			5,400 cy removed.
	10-29-71	60,800	
7-72			~13,300 cy removed.
	11-7-72	64,000	
	5-2-73	44,900	
10-73			16,600 cy removed.
	10-19-73	61,500	
	6-25-74	61,100	
	6-20-75	58,700	
10-76			6,200 cy removed.
	10-29-76	64,900	
	6-23-78	14,350	
10-78			
	11-1-78	62,715.1	
11-78			48,400 by removed.
12-80			48184 C.Y Estimated Debris 47292 C.Y Excavated New T-259 w/ Debris Slope = 0.0122
	12-1-80	50720 54264	Computer "
	11-11-82	55474	
	4-1-83	9966	

1

6. Typical hydrographs during major storm events, South Central Region

DISCHARGE HYDROGRAPH

CALLEGUAS CREEK AT CAMARILLO STATE HOSPITAL (Q)

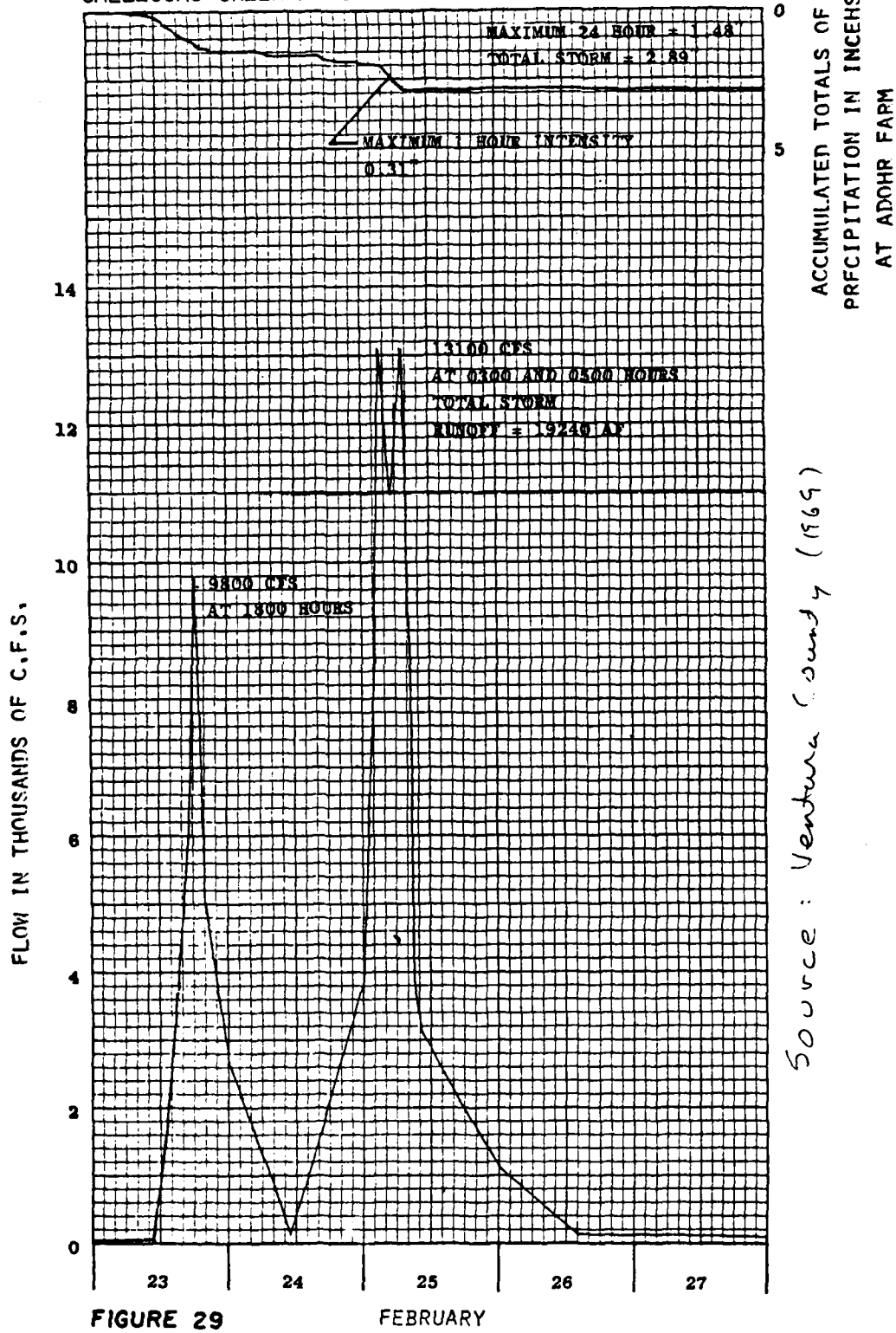


Source: Ventura County (1969)

FIGURE 22

DISCHARGE HYDROGRAPH

CALLEGUAS CREEK AT CAMARILLO STATE HOSPITAL (Q)

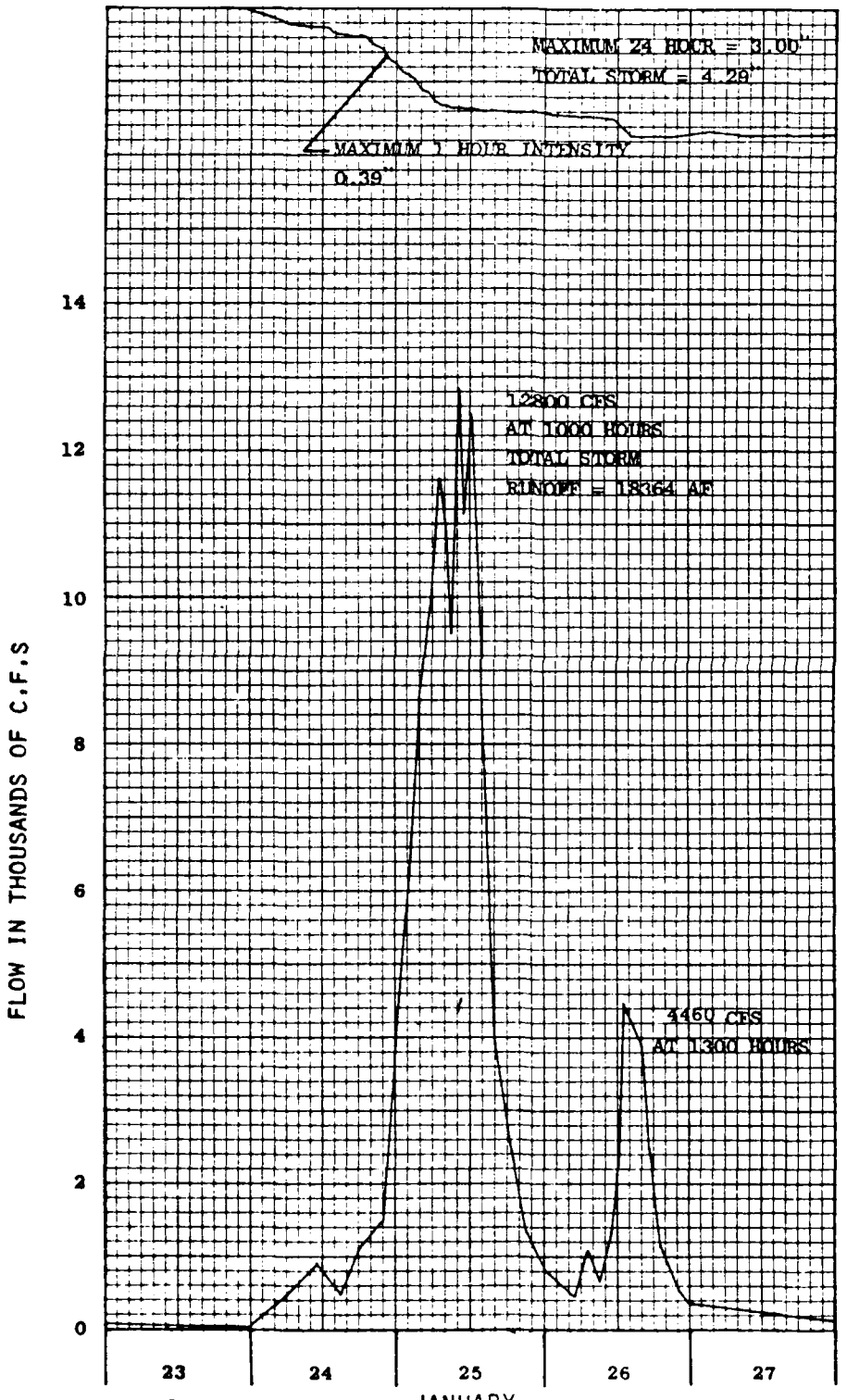


Source: Ventura County (1969)

FIGURE 29

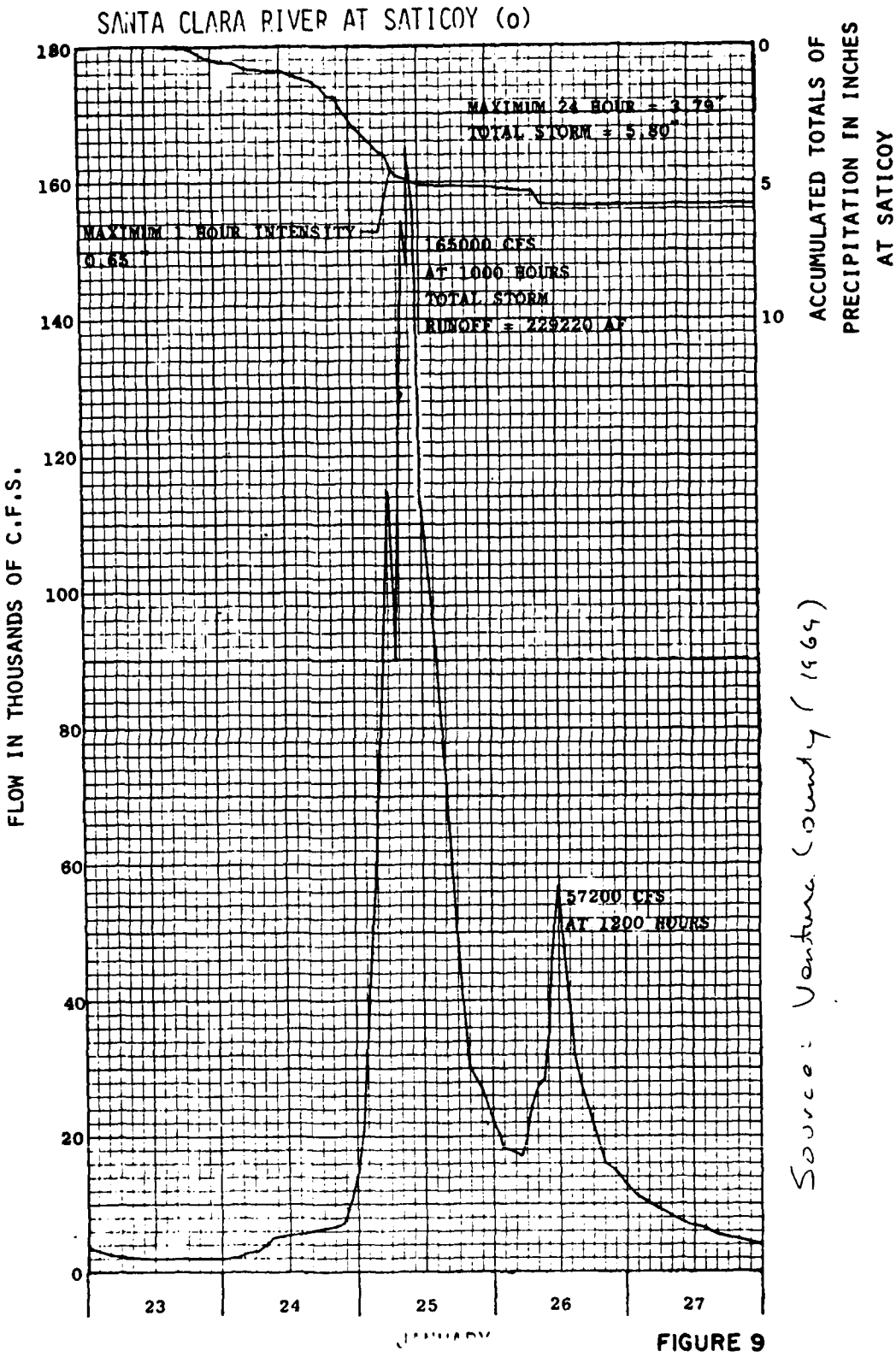
DISCHARGE HYDROGRAPH

CALLEGUAS CREEK AT CAMARILLO STATE HOSPITAL (Q)



Source: Ventura County (1969)

FIGURE 10

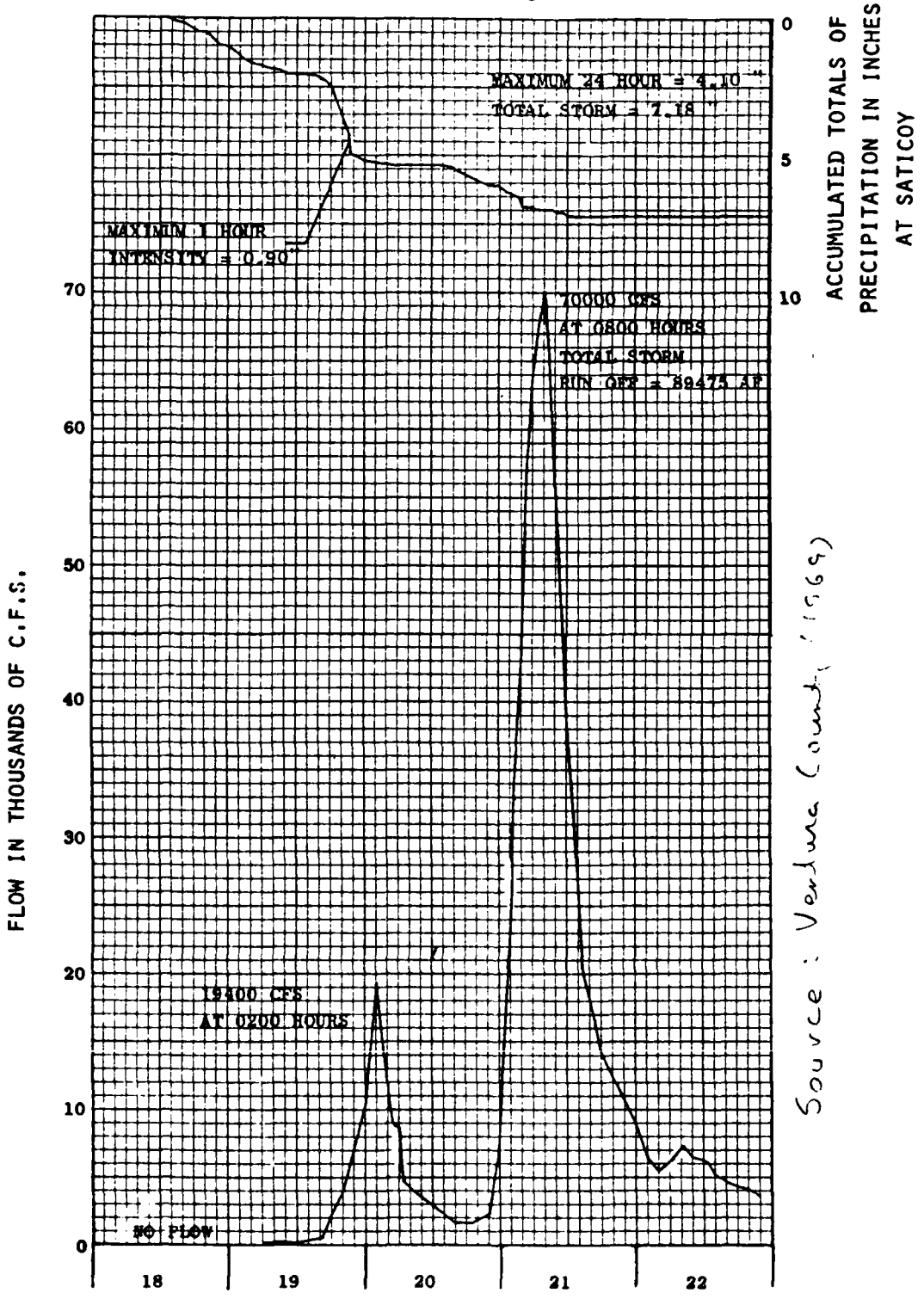


Source: Ventura County (1964)

FIGURE 9

DISCHARGE HYDROGRAPH

SANTA CLARA RIVER AT SATICOY (o)

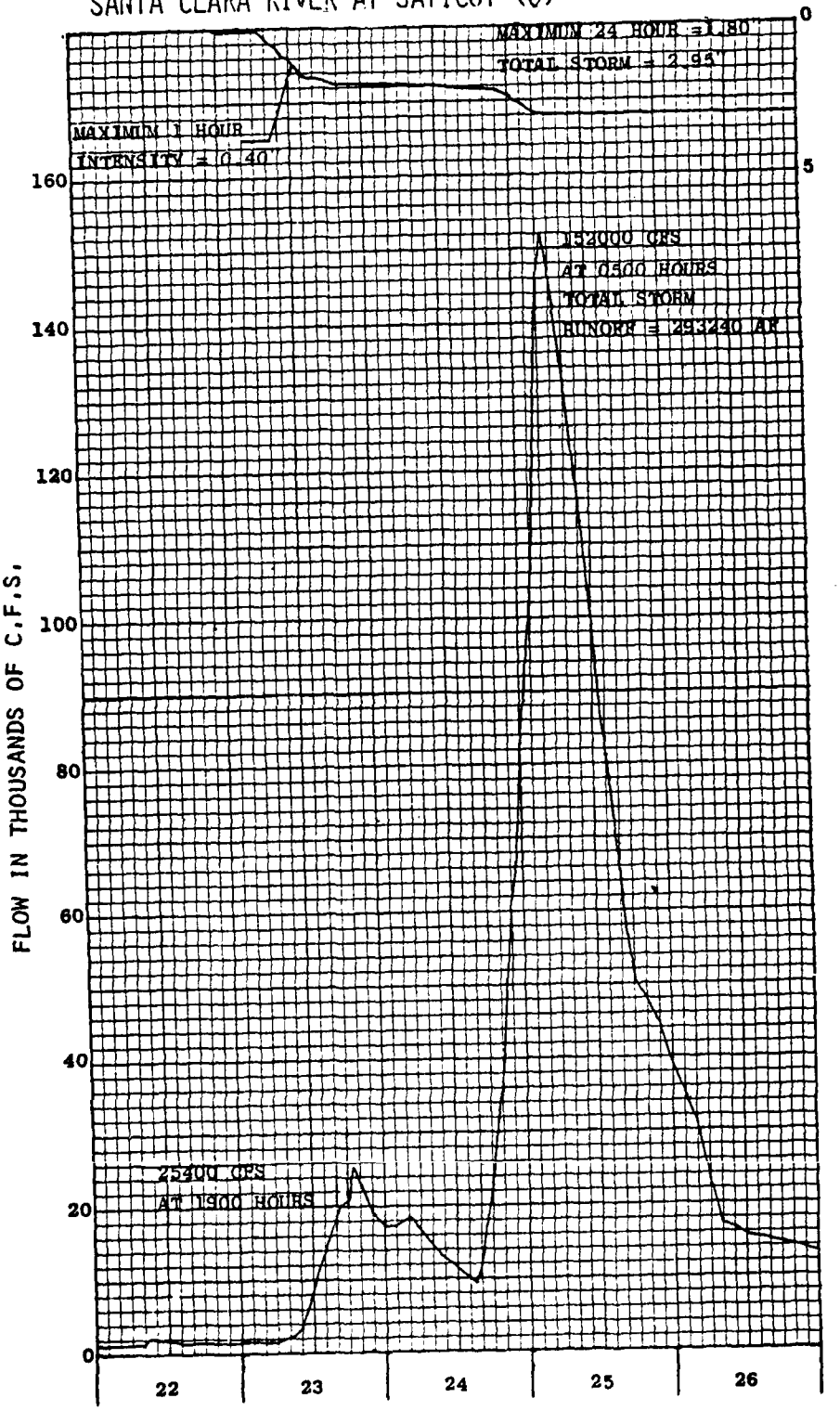


Source: Ventura County, 1969

FIGURE 6

DISCHARGE HYDROGRAPH

SANTA CLARA RIVER AT SATICOY (a)



Source: Ventura County (1969)

FIGURE 27

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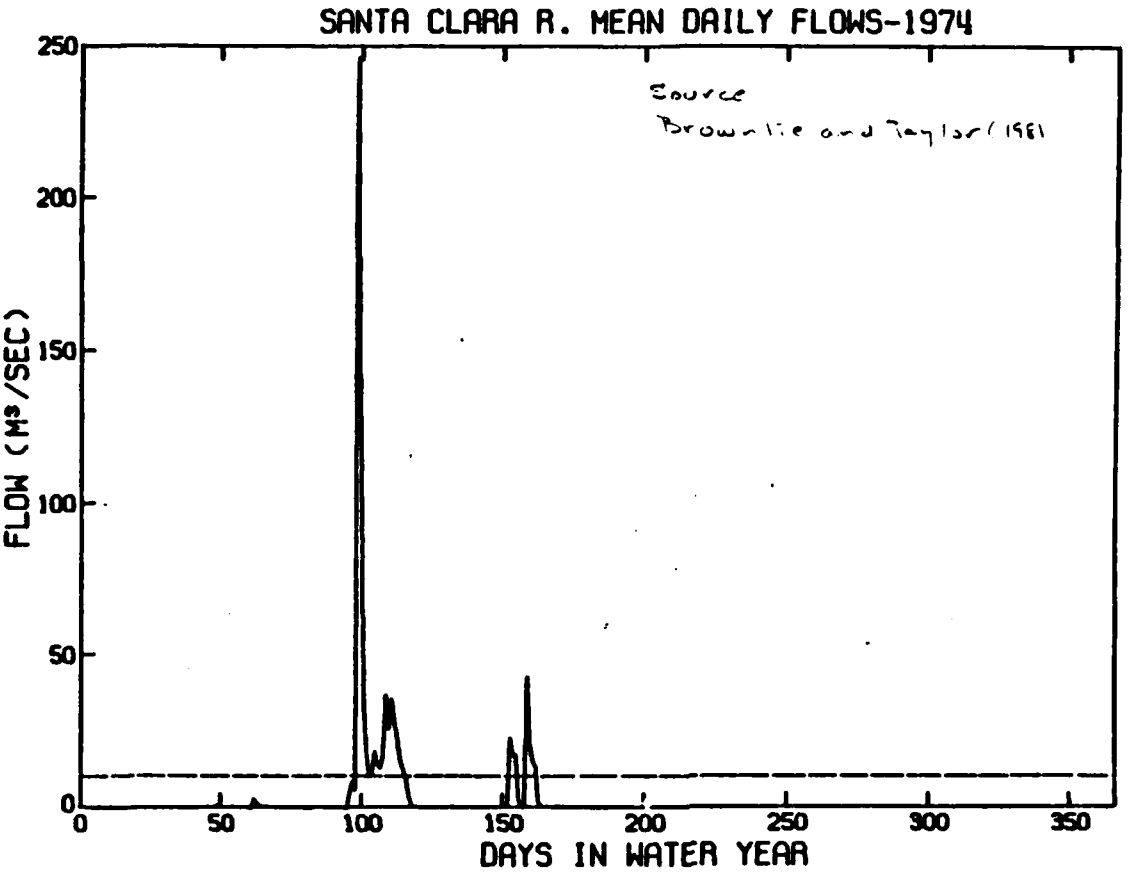
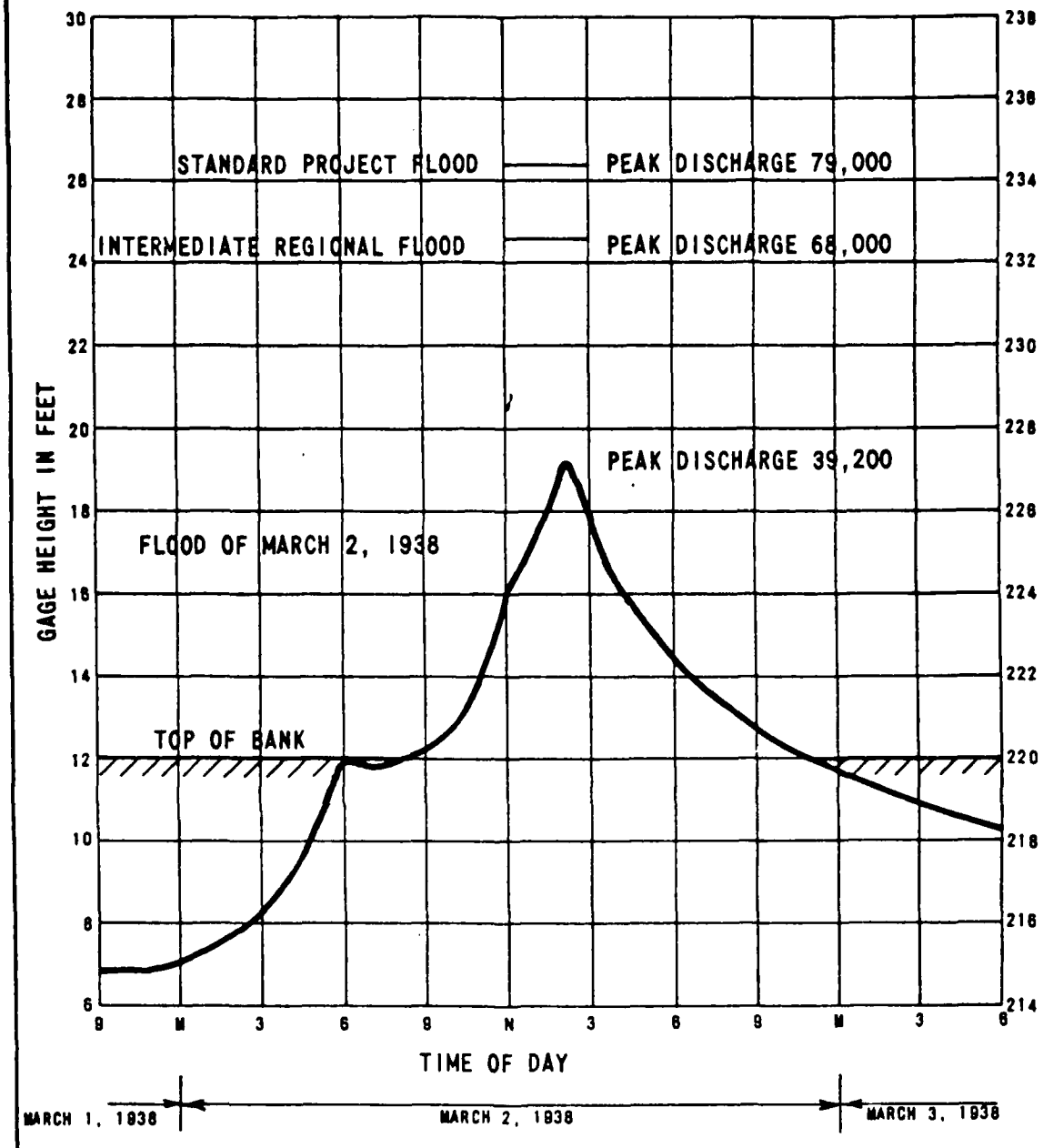


Typical annual sequence of mean daily flows (1974 water year)



STAGE HYDROGRAPH AT STREAM GAGE DOWNSTREAM FROM CASITAS VISTA ROAD BRIDGE.

*GAGE DATUM ESTIMATED AT 208 FEET ABOVE MEAN SEA LEVEL.

Source:
Ventura River
Flood Plain Information
1967

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA

STAGE HYDROGRAPH

VENTURA RIVER
VENTURA COUNTY,
CALIFORNIA

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Source: USGS, 1965) open file report, "Floods of 1965"

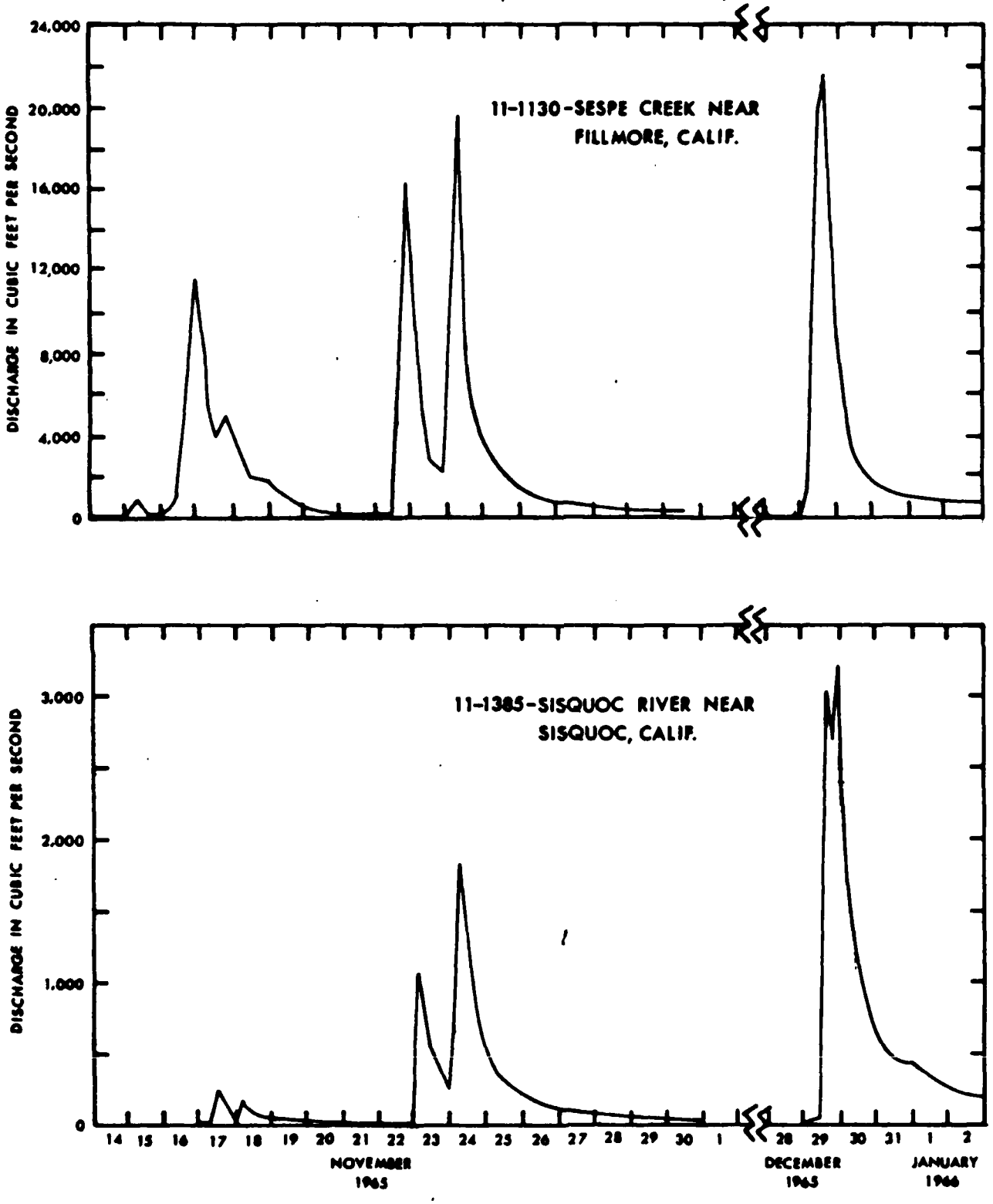
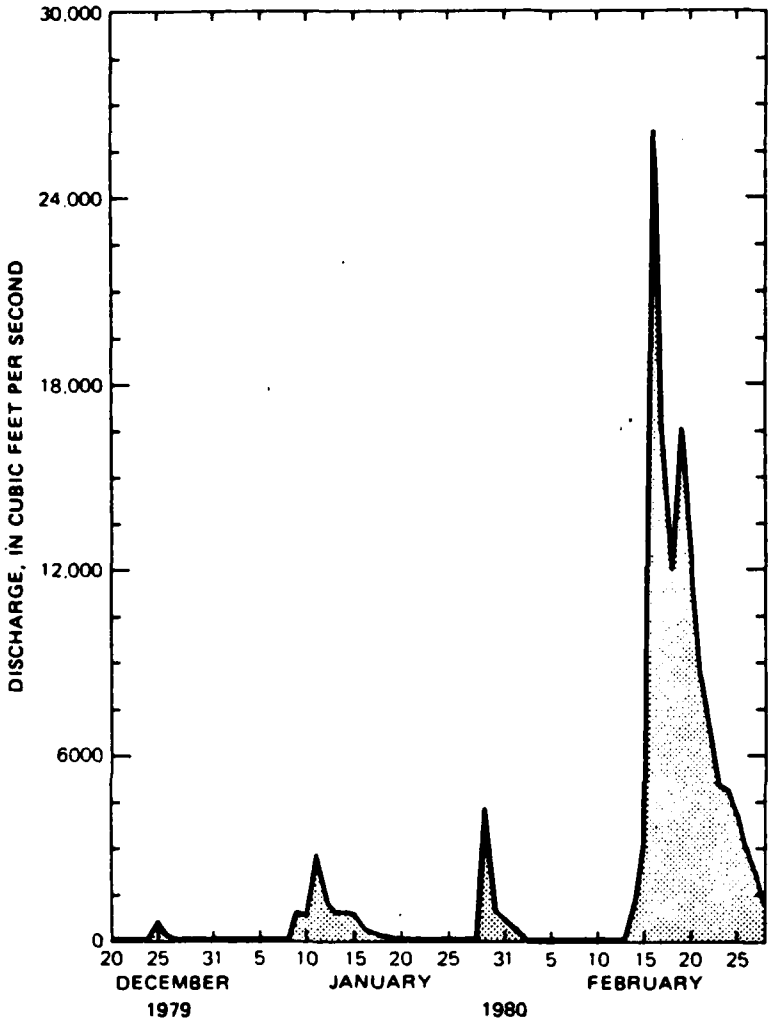
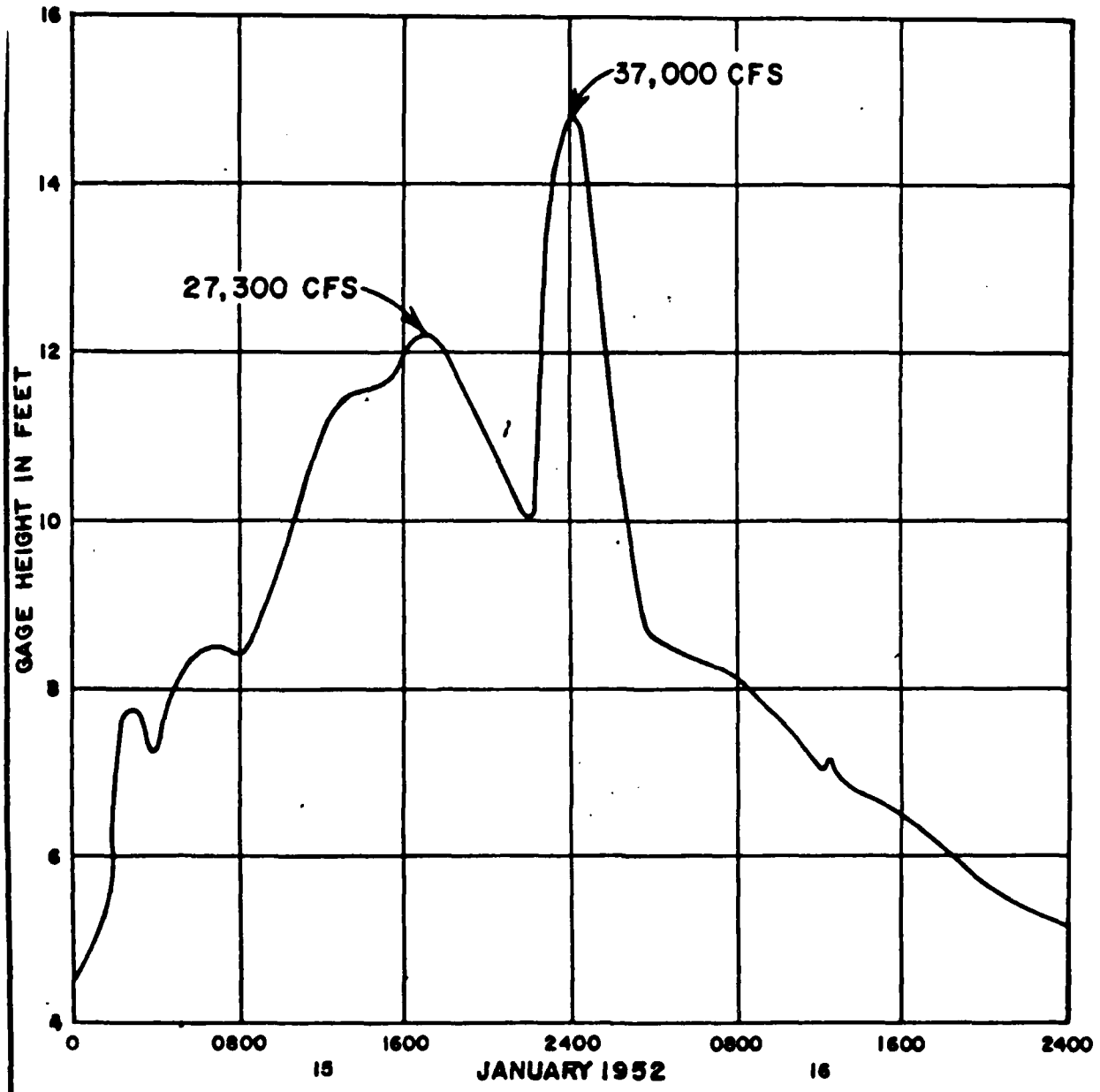


FIGURE 11.--DISCHARGE HYDROGRAPHS FOR SELECTED STREAMS IN THE COASTAL BASINS NORTH OF THE LOS ANGELES RIVER.



Source:
Wahl, Gripp2
and Knuth (1980)

FIGURE 11.--Daily discharge for Santa Clara River at Montalvo.



STREAM GAGE AT
RIVER MILE 36.68
ALISAL ROAD BRIDGE

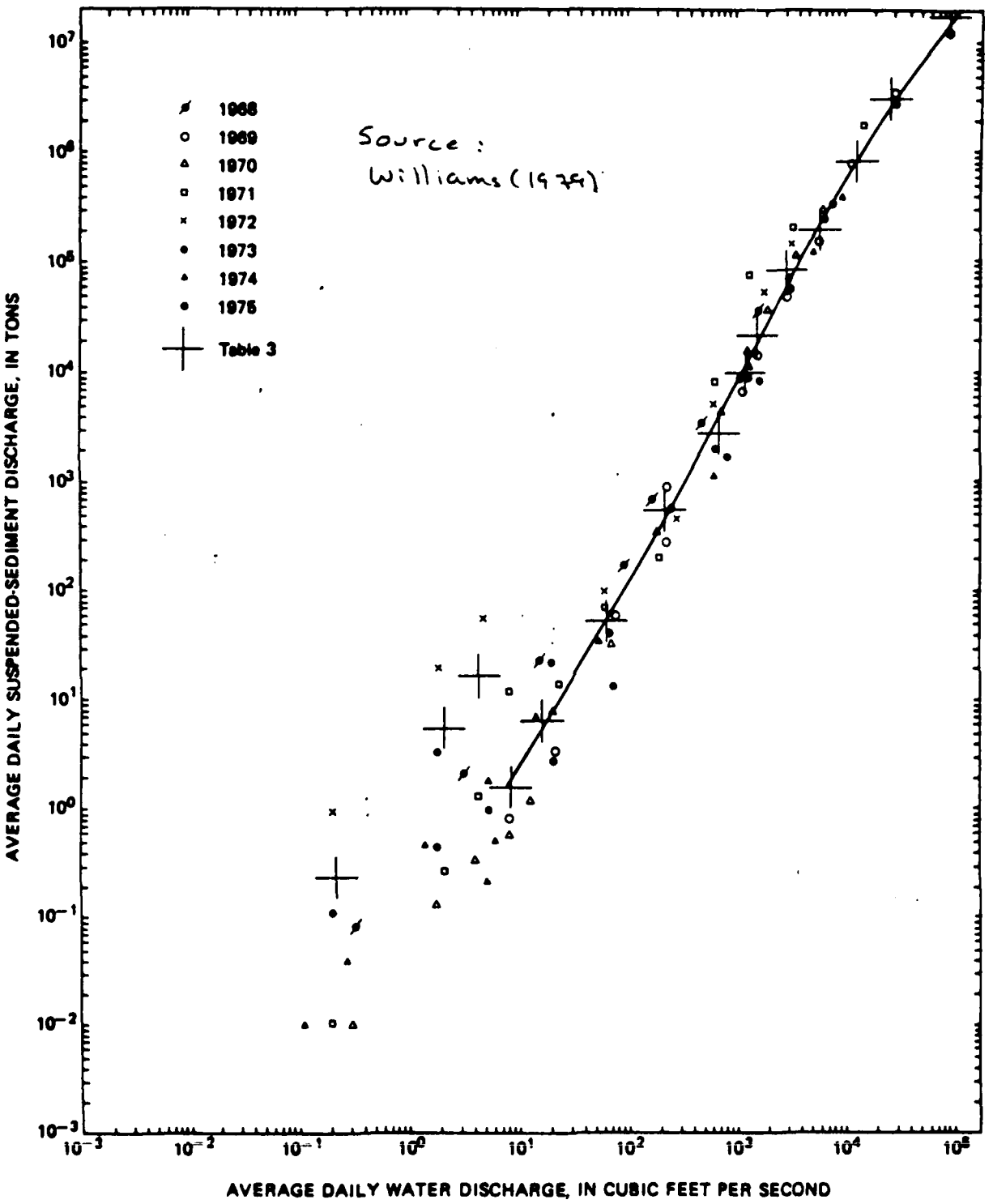
Source:
Santa Ynez R.
Flood Plain Information
1968

CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA

STAGE HYDROGRAPH

SANTA YNEZ RIVER
(FROM CACHUMA DAM TO BUELLTON)
SANTA BARBARA COUNTY
CALIFORNIA
NOVEMBER 1968

7. Sediment size distribution, South Coast Region from U.S. Geological survey publications and Brownlie and Taylor (1981)



--Relation of suspended-sediment discharge to water discharge, Santa Clara River at Montalvo (11114000), water years 1968-75.

Source: Williams (1979)

- Particle-size distribution of suspended sediment and hydraulic properties at time of suspended-sediment sampling--Continued

Date	Time	Water temperature (°C)	Discharge (ft^3/s)	Sediment concentration (mg/L)	Sediment discharge (tons per day)	Particle size Percentage of particles finer than size (millimeters) indicated: 0.002 Clay	0.004 Clay	0.008 Silt	0.016 Silt	0.031 Silt	0.062 Sand	0.125 Sand	0.250 Sand	0.500 Sand	1.000 Sand	2.000 Sand	Hydraulic properties of channel: Area (ft^2)	Width (ft)	Depth (ft)	Velocity (ft/s)
Sespe Creek near Fillmore (11113000)																				
Jan. 14, 1969	1355	12	62	196	33	51	72	84	92	96	99	99	100				30	40	0.73	2.09
Jan. 19, 1969	1450	15	2,000	3,400	18,400	30	35	47	63	83	94	100					328	110	2.98	6.10
Jan. 21, 1969	0800	11	28,000	25,500	1,930,000	17	20	28	42	56	72	89	98	100			3,400	200	17.0	8.24
Jan. 22, 1969	1825	13	8,000	9,230	199,000	17	23	32	43	58	74	87	95	98	99	100	650	126	5.15	12.3
Jan. 22, 1969	1055	13	3,190	1,920	16,500	20	30	41	54	65	73	80	86	91	95	100	325	111	2.92	9.82
Jan. 24, 1969	1820	12	4,360	2,790	32,800	11	15	21	28	38	*48*	*62*	*81*	*98*	*100*		420	131	3.20	10.4
Jan. 26, 1969	1530	12	21,900	20,600	1,220,000	12	14	20	32	45	61	79	91	98	100		1,380	2.03	6.80	15.9
Feb. 8, 1969	1210	12	1,200	1,510	4,890	26	33	46	60	75	88	99	100				153	85	1.80	7.84
Feb. 23, 1969	1715	7	8,570	17,100	396,000	8	11	14	19	27	33	41	56	80	96	99	645	172	3.75	13.3
Feb. 25, 1969	1220	10	13,700	21,300	788,000	13	20	26	37	50	60	76	90	97	100		1,030	212	4.85	13.4
Feb. 28, 1970	1600	11	6,500	8,280	145,000	20	22	28	40	52	65	80	93	99	100		575	181	3.18	11.3
Mar. 3, 1970	0725	9	1,000	1,360	3,670	11	16	22	30	36	45	52	74	100			142	56	2.55	7.04
Nov. 29, 1970	0810	13	8,000	17,600	380,000	13	17	23	36	47	57	72	88	98	100		612	170	3.60	13.1
Dec. 22, 1970	1230	7	350	275	260	33	50	63	75	84	91	92	100				92.8	78	1.19	3.77
Dec. 24, 1971	0900	10	3,650	6,340	62,500	21	27	31	50	66	80	87	96	98	99	100	336	70	4.80	10.9
Dec. 24, 1971	1630	11	3,250	4,060	35,600	23	29	36	56	69	76	77	84	90	91	96	315	70	4.50	10.3
Dec. 27, 1971	1400	8	1,470	2,790	11,100	14	16	22	29	38	46	50	65	92	98	100	165	54	3.05	8.91
Dec. 28, 1971	1220	7	545	634	933	35	43	52	62	70	78	81	89	96	100		100	50	2.00	5.45
Feb. 11, 1973	1430	10	11,200	18,900	584,000	13	14	21	29	42	56	76	90	99	100		912	212	4.30	12.3
Feb. 12, 1973	1230	10	2,800	4,060	30,700	15	22	30	39	51	68	81	91	98	100		300	71	4.20	9.33
Feb. 15, 1973	1700	11	680	143	263						81	87	94	100			150	47	3.19	4.53
Jan. 7, 1974	1205	9	6,500	10,400	183,000	23	28	43	58	74	90	98	100				520	75	6.93	12.5
Jan. 8, 1974	1215	8	1,090	1,290	3,800						83	91	99	100			174	65	2.68	6.26
Jan. 17, 1974	1220	10	644	302	525						51	56	66	79	92	100	109	50	2.18	5.91
Mar. 8, 1974	1805	9	495	169	226												132	58	2.30	3.75
Dec. 4, 1974	0935	12	2,380	5,200	33,400	18	25	35	47	59	71	86	96	99	100		273	70	3.90	8.72
Dec. 4, 1974	1600	12	1,720	4,890	22,700	34	46	64	79	88	93	96	99	100			214	67	3.19	8.04
Mar. 6, 1975	1355	10	2,850	3,120	24,000	23	32	46	59	70	78	85	90	97	100		294	70	4.20	9.69
Mar. 8, 1975	1700	12	3,750	2,820	28,600	19	27	38	51	65	78	87	94	100			343	70	4.90	10.9

Source: Williams (1979

- Particle-size distribution of suspended sediment and hydraulic properties at time of suspended-sediment sampling--Continued

Date	Time	Water temperature (°C)	Discharge (ft^3/s)	Sediment concentration (mg/L)	Sediment discharge (tons per day)	Particle size: Percentage of particles finer than size (millimeters) indicated: 0.002 (Clay)	0.004 (Clay)	0.008 (Silt)	0.016 (Silt)	0.031 (Silt)	0.062 (Sand)	0.125 (Sand)	0.250 (Sand)	0.500 (Sand)	1.000 (Sand)	2.000 (Sand)	Hydraulic properties of channel: Area (ft^2)	Width (ft)	Depth (ft)	Velocity (ft/s)
Santa Clara River at Montalvo (11114000)																	Santa Clara River at Montalvo (11114000)--Continued			
Jan. 19, 1969	1100	11	42	2,050	232	67	73	83	93	100							23	45	0.51	1.83
Jan. 20, 1969	0305	13	14,500	18,800	736,000	21	26	31	47	60	73	90	97	100			2,050	512	4.00	7.07
Jan. 25, 1969	1015	14	163,000	91,400	40,200,000	26	34	40	60	77	91	100					16,730	1,560	10.7	9.86
Jan. 25, 1969	1725	13	56,100	71,200	10,800,000	22	26	32	50	66	78	95	99	100			5,800	892	6.5	4.67
Jan. 26, 1969	1540	13	28,700	21,100	1,640,000	17	19	25	34	44	54	71	89	97	100		3,450	683	5.05	8.32
Feb. 6, 1969	0900	10	16,400	53,400	2,360,000	22	23	32	44	71	73	94	99	100			2,250	542	4.15	7.29
Feb. 19, 1969	1000	11	970	3,420	8,960	26	37	53	71	82	89	97	100				255	163	1.56	3.80
Dec. 21, 1970	0700	15	6,100	45,900	756,000	22	30	36	50	63	74	82	92	98	100		1,050	342	3.07	5.81
Dec. 21, 1970	1200	15	5,400	36,600	534,000	26	33	40	60	74	83	90	96	98	100		950	322	2.95	5.68
Jan. 4, 1971	0700	14	3.5	1,150	11	9	13	17	20	22	24	28	55	96	100		3.3	12	.27	1.06
Dec. 23, 1971	1000	8	336	1,440	1,310	41	57	76	89	95	96	97	98	99	100		114	114	1.00	2.95
Dec. 24, 1971	1700	9	5,300	16,700	239,000	32	34	42	60	72	79	87	97	99	100		940	319	2.95	5.64
Dec. 25, 1971	1700	9	961	3,830	9,940	23	34	43	52	61	66	68	81	94	100		253	162	1.56	3.80
Dec. 26, 1971	1200	8	1,580	9,840	42,000	26	29	39	49	55	59	62	83	96	100		370	194	1.91	4.27
Dec. 27, 1971	1200	8	6,000	22,900	321,000	30	36	42	58	71	80	85	94	99	100		1,050	343	3.06	5.71
Dec. 27, 1971	1700	8	3,030	11,300	92,400	31	35	43	60	72	78	83	91	99	100		610	249	2.45	4.97
Jan. 26, 1972	0800	6	.69	15,300	29	60	84	96	98	98	100						.36	2.0	.18	1.92
Jan. 27, 1972	0700	5	.92	9,480	24	59	75	96	99	99	100						.60	3.0	.20	1.53
Oct. 5, 1972	1030	20	.35	8,570	8.1	66	83	95	96	99	99	100					.28	1.9	.15	1.90
Nov. 15, 1972	0830	14	133	900	323	50	72	87	96	99	100						56	79	.71	2.38
Nov. 15, 1972	1330	16	70	597	113	50	70	87	95	99	*100*						34	58	.59	2.06
Nov. 18, 1972	1015	12	9.4	282	7.2	50	65	76	87	94	97	99	100				7.1	21	.34	1.32
Jan. 16, 1973	1300	13	1.4	7,790	29	32	40	49	63	77	93	99	100				1.6	7.3	.22	.88
Jan. 18, 1973	1600	12	3,300	14,100	126,000	36	37	46	61	79	94	97	98	100			660	263	2.51	5.00
Feb. 6, 1973	1230	12	2,860	13,400	103,000	27	33	44	58	74	86	93	97	100			590	246	2.40	4.85
Feb. 10, 1973	1300	13	1,150	33,300	103,000	21	26	35	48	64	75	90	96	99	100		292	172	1.70	3.94
Feb. 11, 1973	1330	12	20,500	35,400	1,196,000	19	23	33	45	60	71	87	94	99	100		2,700	600	4.50	7.59
Mar. 8, 1973	1630	13	1,000	996	2,690	70	84	89	92	93	95	98	100				265	168	1.58	3.77
Mar. 11, 1973	1230	12	900	2,020	4,910	34	47	62	80	94	99	100					242	160	1.51	3.72
Apr. 12, 1973	1430	15	.50	314	0.4	65	85	93	98	99	99	99	100				.34	2.0	.17	1.47
Jan. 4, 1974	1015	7	51	1,250	172	42	57	74	89	97	99	99	100				26	41	.64	1.92
Jan. 8, 1974	1000	7	4,440	9,990	120,000	31	37	50	65	77	87	95	99	100			840	300	2.80	5.29
Dec. 4, 1974	0930	14	6,500	14,400	253,000	45	55	73	88	96	100						1,120	358	3.13	5.80
Dec. 6, 1974	1145	15	3.0	323	2.6	41	58	62	74	85	91	95	96	98	100		3.0	12	.26	1.00
Dec. 28, 1974	1030	9	150	1,140	462	72	87	97	97	99	100						61	65	.94	2.46
Dec. 28, 1974	1530	10	200	1,240	670	70	84	90	93	96	96	96	99	100			76	72	1.06	2.63
Feb. 4, 1975	0900	10	400	253	273	50	68	79	89	94	95	97	98	100			130	89	1.46	3.08
Feb. 9, 1975	1030	12	1,000	566	1,530	67	84	92	98	99	99	100					265	169	1.57	3.77
Mar. 6, 1975	0900	12	3,790	16,400	168,000	24	25	38	51	66	79	86	92	100			730	273	2.67	5.19
Mar. 7, 1975	0845	12	3,420	6,770	62,500	18	22	28	37	47	56	63	78	97	100		680	267	2.55	5.03
Mar. 8, 1975	1315	12	10,500	18,100	513,000	19	25	32	45	59	72	82	92	99	100		1,600	446	3.59	6.56
Apr. 5, 1975	1730	14	1,150	45,400	47,800	37	49	71	90	97	100						290	173	1.68	3.97

Source: Williams (1979)

- Particle-size distribution of suspended sediment and hydraulic properties at time of suspended-sediment sampling

Date	Time	Water temperature (°C)	Discharge (ft^3/s)	Sediment concentration (mg/L)	Sediment discharge (tons per day)	Particle size: Percentage of particles finer than size (millimeters) indicated: 0.002 (Clay)	0.004 (Clay)	0.008 (Silt)	0.016 (Silt)	0.031 (Silt)
Santa Clara River at Los Angeles-Ventura County line (11108500)										
Nov. 5, 1968	1420	22	1.9	94	0.48	35	49	66	73	77
Jan. 19, 1969	1220	14	10	309	8.3	41	57	66	69	71
Jan. 20, 1969	0100	11	466	22,300	28,100	33	46	60	76	84
Mar. 12, 1969	1045	11	504	5,050	6,870	19	28	33	43	53
Mar. 1, 1970	1335	13	600	25,800	41,800	26	28	37	50	65
Nov. 29, 1970	1210	13	9,000	42,100	1,020,000	20	27	36	54	69
Nov. 29, 1970	1430	12	4,820	47,500	618,000	21	29	41	54	67
Dec. 21, 1970	0740	7	2,220	34,600	207,000	23	31	39	52	64
Dec. 21, 1970	1655	10	870	10,300	24,200	27	35	45	59	72
Dec. 22, 1971	0715	10	61	10,600	1,750	39	51	69	90	93
Dec. 22, 1971	1640	13	201	2,870	1,560	45	60	76	86	92
Dec. 27, 1971	0810	7	963	24,300	63,200	35	39	52	74	94
Dec. 27, 1971	1120	6	3,190	20,700	178,000	31	38	44	65	81
Dec. 27, 1971	1240	7	1,470	21,900	86,900	24	33	44	58	72
Feb. 15, 1972	1705	18	46	215	27					
Mar. 17, 1972	1030	18	14	467	18	31	41	47	55	60
Nov. 14, 1972	1230	13	86	2,310	536	50	68	84	91	94
Nov. 14, 1972	1630	14	512	4,490	6,210	44	56	74	83	91
Dec. 4, 1972	1300	13	93	1,700	427	32	51	74	87	89
Feb. 6, 1973	0720	11	318	4,630	3,980	31	41	57	71	80
Feb. 10, 1973	1700	13	942	11,300	28,700	22	26	31	45	60
Feb. 11, 1973	0640	11	10,600	27,300	781,000	29	31	44	62	78
Feb. 11, 1973	1215	11	4,680	27,700	350,000	16	19	27	38	52
Mar. 21, 1973	1325	12	421	1,960	2,230	14	18	25	33	46
Nov. 23, 1973	0720	8	21	503	29	36	49	57	62	64
Dec. 1, 1973	1540	15	32	248	21					
Dec. 10, 1973	0800	9	21	181	10					
Jan. 4, 1974	1345	15	373	3,560	3,590	37	49	62	68	70
Jan. 6, 1974	0835	5	189	3,110	1,590	33	50	66	77	81
Jan. 7, 1974	1125	8	2,160	8,670	50,600	28	33	47	62	74
Jan. 28, 1974	1730	16	46	56	7.0					
Oct. 7, 1974	0915	17	21	593	34	44	54	67	78	82
Dec. 4, 1974	0720	12	2,210	10,000	59,700	34	44	61	76	86
Dec. 4, 1974	1135	13	152	3,730	1,530	37	49	64	73	79
Mar. 8, 1975	0715	12	1,160	8,780	27,500	29	43	58	75	88
Mar. 22, 1975	0720	12	25	2,530	171	29	38	54	72	85
Apr. 9, 1975	0705	9	116	4,730	1,480	33	43	57	72	83

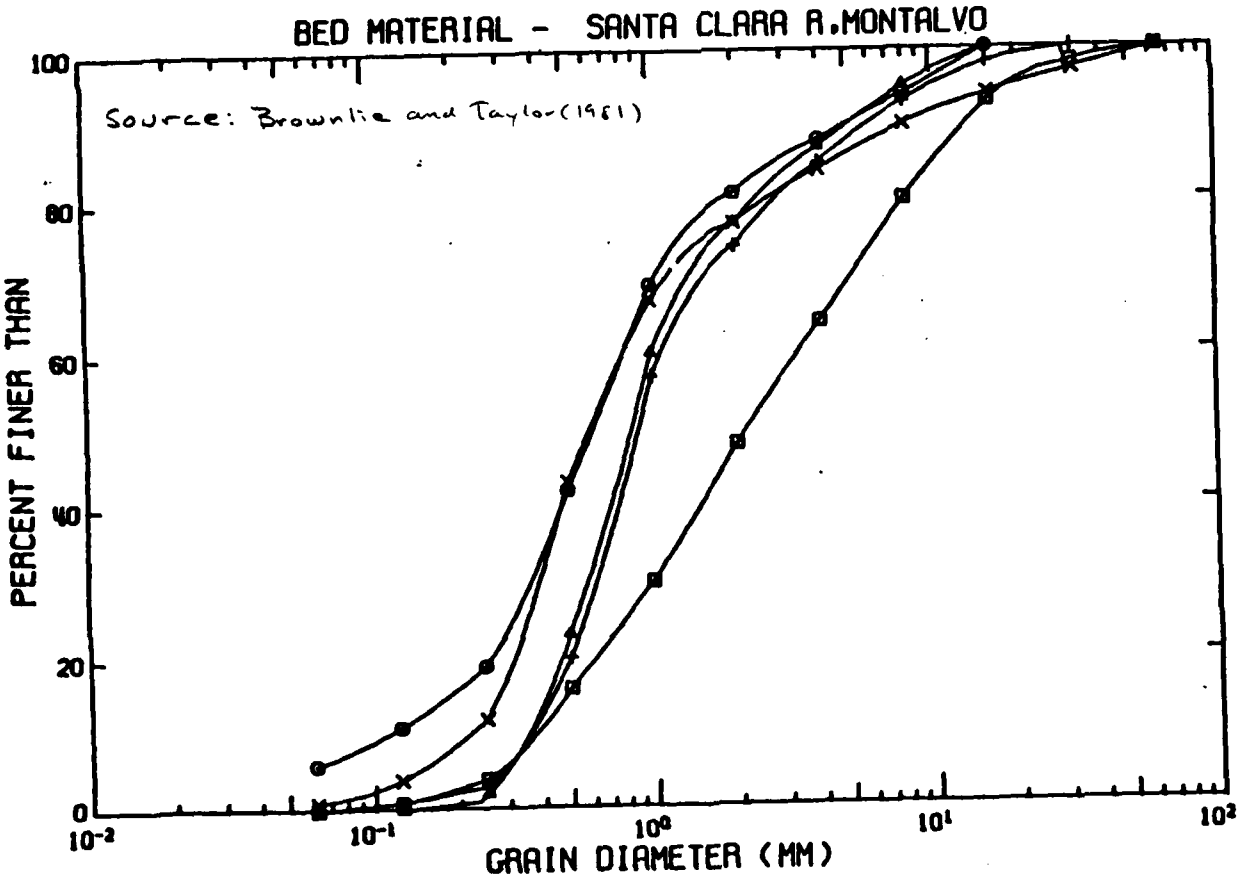
Particle size: Percentage of particles finer than size (millimeters) indicated: 0.062 (Sand)	0.125 (Sand)	0.250 (Sand)	0.500 (Sand)	1.000 (Sand)	2.000 (Sand)	Hydraulic properties of channel: Area (ft^2)	Width (ft)	Depth (ft)	Velocity (ft/s)
Santa Clara River at Los Angeles-Ventura County line (11108500)--Continued									
83	90	98	100			1.0	3.4	0.29	1.90
79	81	94	100			4.86	6.0	.81	2.06
90	93	97	99	100		90	82	1.10	5.18
65	89	100				102	132	.77	4.92
78	91	98	100			100	97	1.03	6.00
79	83	95	100			750	64	11.8	12.0
74	77	84	99	100		460	75	6.1	10.5
74	87	97	99	100		225	75	3.0	9.87
84	93	98	99	100		110	74	1.49	7.91
95	96	98	100			20	42	.48	3.05
94	96	100				48	73	.66	4.19
97	98	100				148	106	1.40	6.51
88	91	96	97	100		350	86	4.05	4.11
79	86	96	99	100		205	102	2.00	7.17
59	63	97	100			16	36	.45	2.88
65	68	75	87	95	100	4.0	11	.36	3.50
95	96	99	100			26	49	.53	3.31
94	97	99	100			105	111	.95	4.88
91	92	96	99	100		27	50	.54	3.44
86	92	98	100			75	73	1.03	4.24
70	81	92	99	100		158	105	1.50	5.96
90	97	99	100			850	61	13.9	12.5
67	86	96	99	100		460	77	5.95	10.2
64	89	99	100			72	67	1.07	5.85
65	68	89	100			9.1	17	.54	2.31
44	49	72	96	100		12	22	.58	3.56
8	8	26	75	100		9.1	17	.54	2.31
72	72	80	99	100		75	73	1.03	4.97
82	83	90	98	100		45	54	.84	4.20
81	86	94	100			270	96	280	8.00
68	82	91	100			16	40	.38	2.97
84	87	94	98	100		9.0	22	.40	2.33
90	93	98	100			275	96	2.85	8.04
82	84	89	98	100		43	41	1.05	3.53
94	98	100				175	97	1.80	6.63
89	91	96	100			11	26	.43	2.27
87	92	98	100			34	41	.83	3.41

11113000 SANTA CLARA RIVER AT SATICOY, CALIF.--Continued

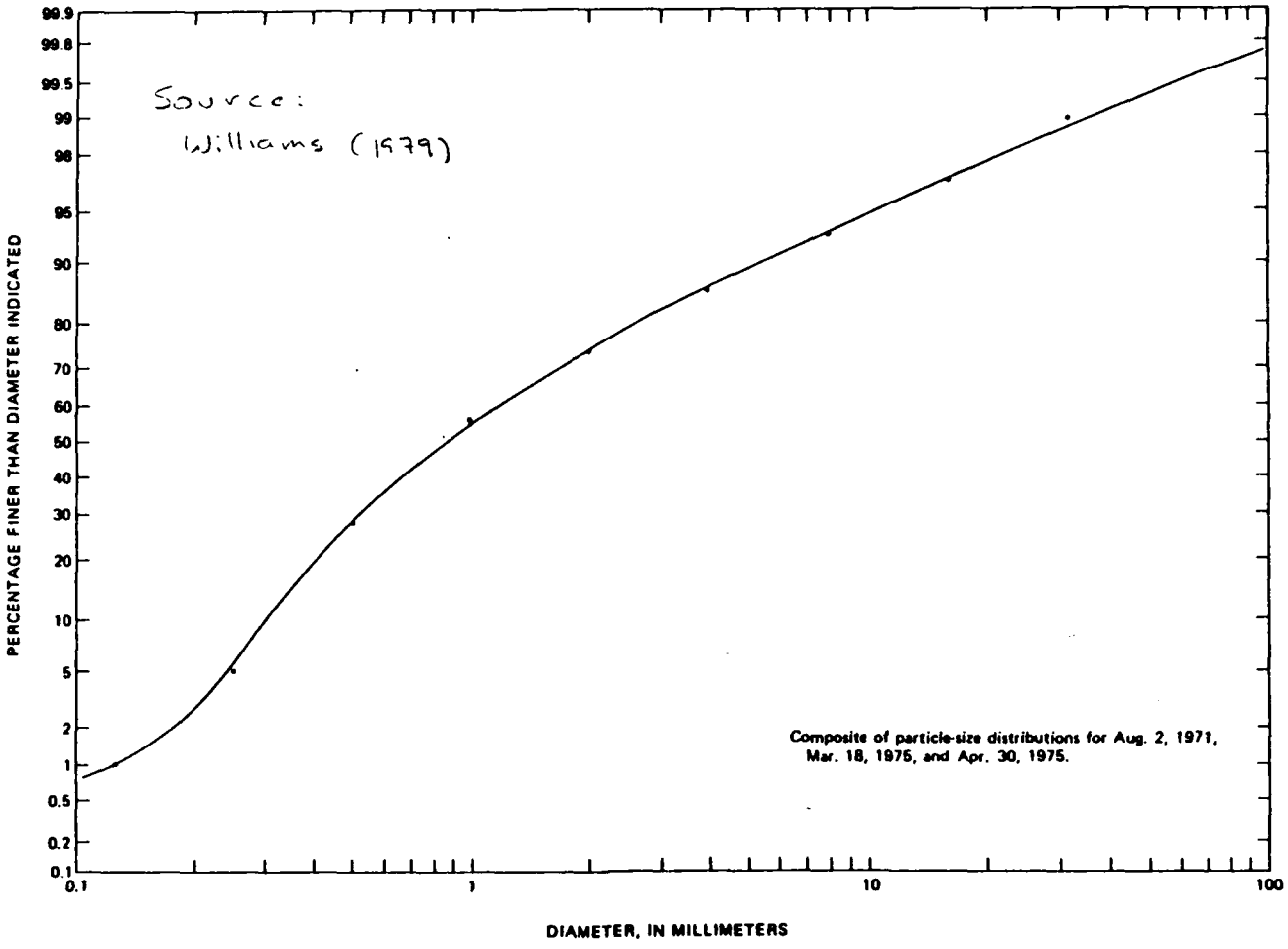
SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
METHODS OF ANALYSIS: P, BOTTOM WITHDRAWAL TUBE; C, CHEMICALLY DISPERSED; N, IN NATIVE WATER; P, PIPET; S, SIEVE; V, VISUAL ACCUMULATION TUBE; W, IN DISTILLED WATER

DATE	TIME	WATER TEMPERATURE (°C)	DISCHARGE (CFS)	CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	METHOD OF ANALYSIS
JAN 19, 1969	1150	11	42	2040	232	67	73	83	91	100	—	—	—	—	—	—	SPNC
JAN 20.....	0305	13	14900	16800	716000	21	26	31	47	68	73	88	97	100	—	—	SPNC
JAN 29.....	1015	14	1630000	91400	402000000	26	34	40	60	77	91	100	—	—	—	—	SPNC
JAN 29.....	1725	13	96100	71200	18600000	22	26	32	50	66	78	95	99	100	—	—	SPNC
JAN 30.....	1500	13	28700	21100	1630000	17	19	25	34	44	54	71	90	97	100	—	SPNC
FEB 6.....	0900	10	10400	51400	2360000	22	23	32	44	71	73	94	98	100	—	—	SPNC
FEB 19.....	1000	11	970	3420	8960	26	37	53	71	92	89	97	100	—	—	—	SPNC



Composite bed material samples collected at station 11114000, between August 2, 1971, and September 30, 1975.

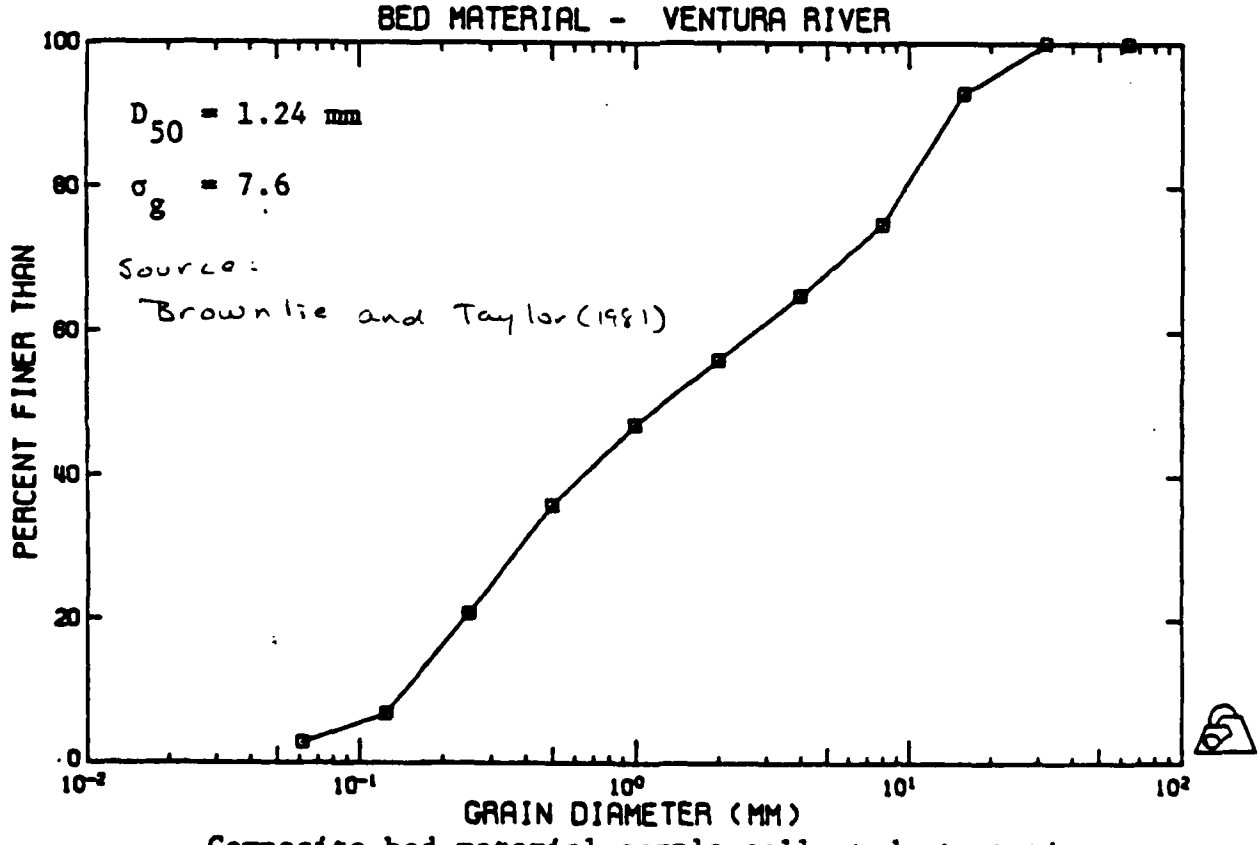


--Particle-size distribution of bed material, Santa Clara River at Montalvo (11114000), determined by sieve analysis.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

PARTIC.e-DISTRIC TION OF S SPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(METHODS OF ANALYSIS: B. BOTTOM WITHDRAWAL TUBE; C. CHEMICALLY DISPERSED; N. IN NATIVE WATER; P. PIPET; S. SIEVE; V. VISUAL ACCUMULATION TUBE; W. IN DISTILLED WATER)

DATE	TIME	WATER TEMPERATURE (°C)	DISCHARGE (CFS)	CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	METHOD OF ANALYSIS
JAN 19, 1969	0930	11	152	197	81	62	83	92	94	95	97	98	99	100	--	--	SPWC
JAN 20.....	1650	14	160	291	126	57	76	87	93	95	98	100	--	--	--	--	SPWC
JAN 20.....	2255	14	3540	13500	129000	22	28	36	46	59	72	86	96	100	--	--	VPWC
JAN 21.....	0900	15	12000	20800	674000	18	22	34	49	58	71	88	97	100	--	--	VPWC
JAN 24.....	1445	11	2370	2740	17500	15	17	26	33	41	50	66	87	99	100	--	VPWC
JAN 24.....	1840	13	4600	5300	65800	16	18	27	35	45	57	72	87	97	100	--	VPWC
JAN 26.....	1015	11	14200	34400	1320000	14	18	24	31	42	52	72	89	98	100	--	SPWC
FEB 4.....	1300	12	604	640	488	18	29	39	47	51	74	88	99	100	--	--	VBWC
FEB 6.....	1110	11	4160	7300	82000	15	16	23	26	37	46	60	84	97	100	--	VPWC
FEB 8.....	1400	12	1070	1440	4160	30	37	52	67	83	93	98	100	--	--	--	VPWC
FEB 11.....	1520	12	184	1560	775	28	36	48	57	68	76	88	96	99	100	--	VPWC
FEB 24.....	1540	10	19600	29300	1550000	14	16	21	32	43	54	77	92	99	100	--	SPWC
MAR 12.....	1430	14	325	4840	4250	25	36	57	69	85	95	100	--	--	--	--	VPWC



Composite bed-material sample collected at station 11118500, September 18 1973.

CALLEGUAS CREEK BASIN

11106550 CALLEGUAS CREEK AT CAMARILLO STATE HOSPITAL, CALIF.

LOCATION.—Lat 34°13'46", long 119°02'30", in Guadalasca Grant, Ventura County, at gaging station on county bridge, 1.0 mile northeast of Camarillo State Hospital and 1.4 miles downstream from Conejo Creek

DRAINAGE AREA.—343 sq mi.

PERIOD OF RECORD.—Sediment records: October 1968 to September 1969.

EXTREMES.—1968-69:

Sediment concentrations: Maximum daily, 62,000 mg/l Jan. 20; minimum daily, 40 mg/l on several days in January.

Sediment discharge: Maximum daily, 1,700,000 tons Jan. 20; minimum daily, 0.08 ton Jan. 6.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
METHODS OF ANALYSIS: B. BUFFOM WITHDRAWAL TUBE; C. CHEMICALLY DISPERSED; D. IN NATIVE WATER; P. PIPET; S. SIEVE; V. VISUAL ACCUMULATION TUBE; W. IN DISTILLED WATER

Date	Time	Water temperature (°C)	Discharge (cfs)	Suspended sediment concentration (mg/l)	Suspended sediment discharge (tons/day)	Particle size: percent finer than the size (in millimeters) indicated .062	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	Method of analysis
Jan 19, 1969	12[illegible]	--	196	A1,950C	1070	36	42	56	61	71	82	95	98	100	--	--	VSWC
Jan 19.....	2000	--	421	A12300	14030	44	48	58	64	76	86	92	97	100	--	--	VSWC
Jan 19.....	2100	--	1190	A20000	64300	42	44	51	62	78	91	99	100	--	--	--	VSWC
Jan 19.....	2109	--	1800	A16000	80700	42	44	52	61	75	86	98	100	--	--	--	VSWC
Jan 19.....	2119	--	2060	A7[illegible]	[illegible]000	17	21	26	30	39	52	76	94	98	100	--	SPWC
Jan 20.....	0800	12.3	760	12800	26347	30	44	56	66	75	84	91	95	99	100	--	VPWC
Jan 21.....	0810	--	4080	A2[illegible]C	39100A	30	34	50	60	68	76	85	96	100	--	--	VPWC
Jan 29.....	0715	--	7100	A10C000	1[illegible]CCCC	11	16	15	24	35	48	76	93	99	100	--	SPWC
Jan 29.....	1412	14.5	19300	64000	2790648	20	28	34	42	55	67	86	97	100	--	--	SPWC
Feb 1.....	1400	13.3	22	341	20	37	56	65	66	69	76	76	97	100	--	--	SPWC
Feb 18.....	1319	14.3	14	1410	54	0	11	13	15	16	25	38	58	89	100	--	VSWC

A SINGLE-STAGE SAMPLE.

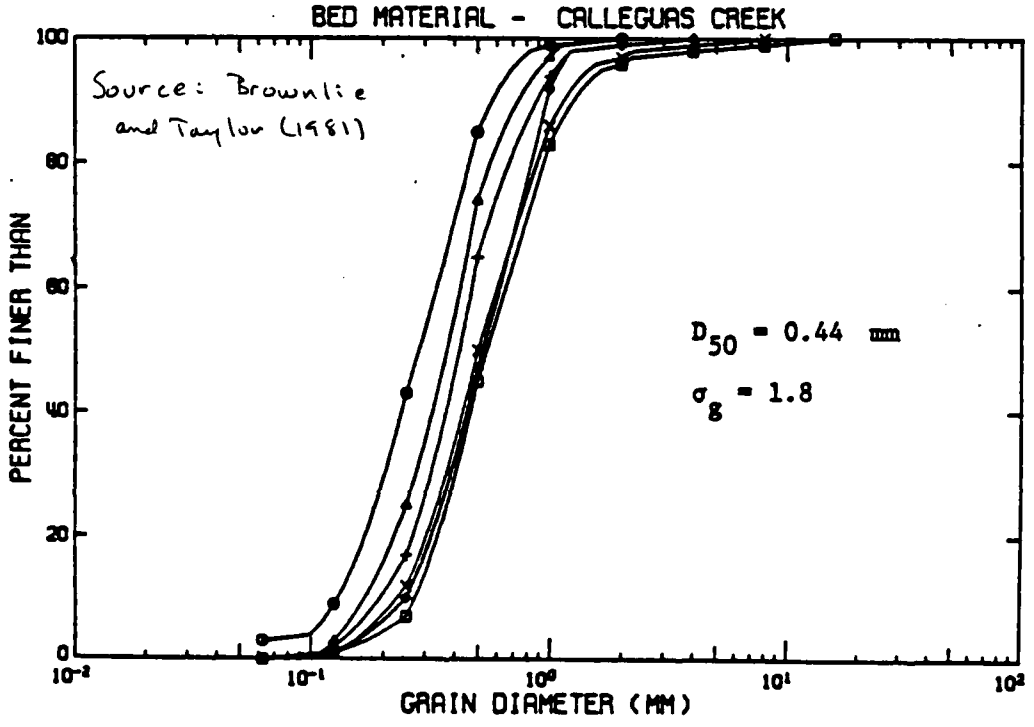


Figure C5-4 Composite bed-material samples collected at station 11106550 between January 20, 1969, and September 30, 1975.

11120000 ATASCADERO CREEK NEAR GOLETA, CA--Continued

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM
JAN										
05...	0820	22	10.5	583	35	--	--	--	--	--
20...	0710	53	7.0	987	141	--	78	85	85	86
20...	1045	239	5.0	960	619	--	44	56	66	75	84
22...	1620	3.4	11.0	17	.16	--	--	--	--	--	--
MAR										
02...	0700	41	13.5	520	58	69	82	89	95	97
11...	1510	43	14.0	934	108	76	88	94	98	99
13...	1445	.19	16.0	13	.00	--	--	--	--	--	--
15...	1740	3.2	15.0	21	.18	--	--	--	--	--	--
16...	1030	97	9.0	1310	343	--	64	75	87	95
17...	1300	80	12.0	218	47	--	--	--	--	--	--
26...	0715	6.0	12.0	35	.57	--	--	--	--	--	--
APR										
11...	0945	263	12.0	1970	1400	--	40	46	55	68
12...	1140	16	19.0	32	1.4	--	--	--	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
JAN										
05...	--	38	--	48	--	57	--	95	100	--
20...	--	87	--	87	--	88	--	92	99	100
20...	--	98	--	95	--	99	--	100	--	--
22...	--	88	--	94	--	100	--	--	--	--
MAR										
02...	--	98	--	99	--	100	--	--	--	--
11...	--	99	--	99	--	100	--	--	--	--
13...	--	85	--	--	--	--	--	--	--	--
15...	--	88	--	91	--	95	--	100	--	--
16...	--	99	--	100	--	--	--	--	--	--
17...	--	98	--	99	--	100	--	--	--	--
26...	--	95	--	97	--	100	--	--	--	--
APR										
11...	83	--	99	--	99	--	100	--	--	--
12...	--	97	--	100	--	--	--	--	--	--

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
AUG											
24...	1400	8	25	49	74	88	98	92	94	96	100

11120530 TECOLOTITO CREEK NEAR GOLETA, CA--Continued

SUMMARY OF WATER AND SEDIMENT DISCHARGE, DECEMBER 1981 TO APRIL 1982

MONTH	WATER DISCHARGE CFS-DAYS	SUSPENDED SEDIMENT DISCHARGE TONS	BEDLOAD DISCHARGE TONS	TOTAL SEDIMENT DISCHARGE TONS
DECEMBER 1981	9.21	0.66	88	89
JANUARY 1982	45.29	361.53	549	911
FEBRUARY.....	8.63	0.80	79	80
MARCH.....	46.97	109.56	990	1110
APRIL.....	70.81	159.48	974	1130
TOTAL.....	180.91	632.03	2680	3320

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
JAN								
05...	0710	5.5	11.0	739	11	59	69	78
20...	0915	1.7	9.0	539	2.5	66	77	79
FEB								
10...	1445	.89	12.5	17	.04	--	--	--
MAR								
11...	1740	4.9	13.0	307	4.1	77	89	99
17...	0745	9.7	9.0	642	17	74	84	92
17...	1100	11	11.0	241	7.2	76	84	91
18...	1215	2.8	12.0	191	1.4	--	--	--
29...	1430	2.1	15.0	123	.70	--	--	--
APR								
01...	0745	15	16.5	212	8.6	59	65	81

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM
JAN							
05...	80	82	84	87	93	99	100
20...	80	82	84	89	95	98	100
FEB							
10...	--	--	81	84	100	--	--
MAR							
11...	99	100	--	--	--	--	--
17...	98	100	--	--	--	--	--
17...	97	100	--	--	--	--	--
18...	--	--	100	--	--	--	--
29...	--	--	100	--	--	--	--
APR							
01...	91	96	100	--	--	--	--

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1980 TO SEPTEMBER 1981

DATE	TIME	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 64.0 MM
AUG												
12...	1200	9	23	40	67	77	82	86	90	94	99	100

11120510 SAN JOSE CREEK AT GOLETA, CA--Continued

SUMMARY OF WATER AND SEDIMENT DISCHARGE, DECEMBER 1981 TO APRIL 1982

MONTH	WATER DISCHARGE CFS-DAYS	SUSPENDED SEDIMENT DISCHARGE TONS	BEDLOAD DISCHARGE TONS	TOTAL SEDIMENT DISCHARGE TONS
DECEMBER 1981	8.83	0.51	17	18
JANUARY 1982	58.35	567.67	274	841
FEBRUARY.....	13.96	0.65	26	27
MARCH.....	161.36	424.68	915	1340
APRIL.....	178.00	2503.99	957	3460
TOTAL.....	420.5	3497.50	2189	5686

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1981 TO SEPTEMBER 1982

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	TEMPER-ATURE (DEG C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
JAN							
05...	0925	4.7	12.0	859	11	66	78
20...	1220	116	8.0	12500	3920	--	54
21...	1035	6.8	9.0	131	2.4	--	--
MAR							
11...	1230	28	15.0	443	33	50	60
19...	1420	8.2	14.0	35	.77	--	--
APR							
12...	1115	9.4	16.0	36	.91	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM
JAN							
05...	83	85	86	86	86	90	100
20...	63	76	85	90	93	98	100
21...	--	--	--	95	96	97	100
MAR							
11...	69	78	85	90	94	97	100
19...	--	--	--	95	98	100	--
APR							
12...	--	--	--	98	100	--	--

11141000 SANTA MARIA RIVER AT GUADALUPE, CALIF.--Continued

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCENTRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCENTRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCENTRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	0	--	0						
2	3.1	9600	80						
3	217	8000	4690						
4	113	5600	1710						
5	118	9510	4320						
6	427	10400	12300						
7	285	6000	4620						
8	162	6900	3020						
9	118	6300	2010						
10	118	7800	2490						
	11	6000	207						
	5.2	6400	90						
13	2.8	6200	47						
14	1.4	6000	23						
15	0	--	0						
16	0	--	0						
17	0	--	0						
18	0	--	0						
19	0	--	0						
20	0	--	0						
21	0	--	0						
22	0	--	0						
23	0	--	-						
24	0	--	0						
25	0	--	0						
26	0	--	-						
27	0	--	0						
28	0	--	0						
29	0	--	0						
30	0	--	0						
31	--	--	--						
TOTAL	1981.5	--	95607	0	--	0	0	--	0

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 0C98[illegible].0
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 9568[illegible].0

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(METHODS OF ANALYSIS: A, BOTTOM WITHDRAWAL TUBE; C, CHEMICALLY DISPERSED; N, IN NATIVE WATER; P, PIPET; S, SIEVE; V, VISUAL ACCUMULATION TUBE; W, IN DISTILLED WATER)

DATE	TIME	WATER TEMPERATURE (°C)	DISCHARGE (CFS)	SUSPENDED SEDIMENT CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	METHOD INDICATED	METHOD OF ANALYSIS
JAN 20, 1969	0910	11	1750	24200	114000	30	44	55	71	78	87	90	98	100	--	--	--	VPWC
JAN 21.....	1600	--	4160	43900	491000	26	39	55	67	77	84	95	81	97	100	--	--	SPWC
JAN 22.....	1700	12	716	19100	36900	50	58	57	73	87	95	99	100	--	--	--	--	VPWC
JAN 29.....	1900	11	784	13900	10700	30	35	45	58	76	82	95	99	100	--	--	--	VPWC
FEB 7.....	1500	13	1270	19600	65200	21	28	32	44	59	75	91	98	100	--	--	--	VPWC
FEB 13.....	0930	6	30	7400	599	63	96	79	89	95	96	100	--	--	--	--	--	VPWC
FEB 25.....	1715	11	7920	63100	1350000	14	15	19	26	38	50	75	94	99	100	--	--	SPWC
FEB 27.....	1745	12	2400	29800	193000	17	21	27	37	51	66	88	97	100	--	--	--	SPWC
MAR 4.....	1845	--	4330	16700	195000	11	13	17	22	32	44	68	93	100	--	--	--	SPWC

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
(METHOD OF ANALYSIS: H, HYDROMETER; O, OPTICAL ANALYZER; S, SIEVE; V, VISUAL ACCUMULATION TUBE)

DATE	TIME	WATER TEMPERATURE (°C)	NUMBER OF SAMPLING POINTS	DISCHARGE (CFS)	PARTICLE SIZE: PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED .062	.125	.250	.500	1.00	2.00	4.00	8.00	16.0	32.0	64.0	METHOD INDICATED	METHOD OF ANALYSIS
NOV 26, 1968	--	--	4	6	5	9	31	75	88	92	96	98	98	100	--	S	
JAN 23, 1969	1600	12	3	18	3	7	46	81	97	99	99	100	--	--	--	S	
FEB 10.....	--	--	18	8	4	20	96	98	98	99	100	--	--	--	--	S	
FEB 13.....	0930	6	3	30	35	51	88	95	99	100	--	--	--	--	--	S	

8. Fire Frequency Tables, from U.S. Forest Service, Los Padres National Forest. Courtesy of Bob Blecker and Fritz Cahill

TOTAL BURNED ACREAGE (1912-1980) BY LARGE STATISTICAL FIRES BY FIRE NUMBERS AND SIZE CLASSES
SHOWING ACREAGE BY CLASSES AND THE % THIS REPRESENTED OF TOTAL ACCUMULATED BURNED ACREAGE (1,593,329)*

Fire Size Class in Acres	No. Fires in Given Size Class	Total Acres Burned by Given Size Class	% of 1,593,329 Acres Burned by Given Size Classes	Total No. of Accum. Fires	Acc. Total Acres Burned by Acc. Size Classes	Acc. % of 1,593,329 Acres Burned by All Size Classes	Ave. Sized Fire by Size Classes in Acres	Outside Acres Burned	No. Fires Involved in Total Outside Burned Acres	Accum. Total Outside Acres
>100,000	2 (0)	393,574	24.7	2	393,574	24.7	196,787	3,546	(1)	3,546
> 50,000	5 (0)	331,110	20.8	7	724,684	45.5	66,222	44,141	(3)	47,687
> 20,000	12 (1)**	310,340	19.5	19	1,035,024	65.0	25,862	103,760	(10)	151,447
> 10,000	17 (0)	219,369	13.8	36	1,254,393	78.8	12,904	85,214	(10)	236,661
> 5,000	20 (2)**	123,818	7.7	56	1,378,211	86.5	6,191	63,368	(11)	300,029
4000-4999	12 (4)**	34,375	2.2	68	1,412,586	88.7	2,865	20,275	(10)	320,304
3000-3999	13 (2)**	37,953	2.4	81	1,450,539	91.1	2,919	22,761	(10)	343,065
2000-2999	16 (5)**	26,020	1.6	97	1,476,559	92.7	1,626	14,240	(6)	357,305
1000-1999	61 (15)**	65,427	4.1	158	1,541,986	96.8	1,073	42,458	(26)	399,763
300- 999	169 (44)**	51,337	3.2	327	1,593,329	100.0	304	134,824	(97)	534,587

*Acreage burned only within paid protection boundary. The fire size classes reflect this; for example, if a fire burned 12 acres in Pay Protection Area and 14,600 acres outside, it would be listed in the 300-999 group since it burned only 12 acres of NF protected land.

**Fires burning completely outside the Forest Boundary were counted, but not their acreage; these fires were included because the Forest Service took action to suppress them because they offer danger to NF values.

INSERT TABLE #4

TABLE 4
LOS PADRES NATIONAL FOREST PROTECTION HISTORY

YEAR	BRUSH AGE CLASS AVERAGE PER ACRE 1,900,000 ACRES	AVERAGE ACRES BURNED PER YEAR BY DECADE	NUMBER OF LARGE FIRES 5,000 A+	NO. OF FIRE STARTS	PRESUPPRESSION AND SUPPRESSION COSTS BY DECADE (All figures converted to Base Year 1967)	POTENTIAL RESOURCE DAMAGE - ON-SITE/ OFF-SITE BY DECADE (Dollar figure converted to Base Year 1967)
1890	31					
1900	26					
1910	33	15,000 A/Yr	7	283		
1920	38	48,200 A/Yr	25	265		
1930	32	32,000 A/Yr	7	265		
1940	35	9,600 A/Yr	10	289	$ 4,394,000	$53,000,000
1950	42	15,400 A/Yr	7	369	11,141,000	58,000,000
1960	47	22,500 A/Yr	4	553	23,346,000	72,000,000
1970	48	27,253 A/Yr	6	980	43,516,514	71,529,000
1980	47	25,480 A/Yr	*10	*942	* 86,000,000	* 71,000,000
1990						

* Projected figures based on projected fire frequency by Fire Analysis data for the 1980s.

TABLE 8

SUMMARY OF LOS PADRES FOREST BRUSH AGE CLASSES
AND APPROXIMATE ACREAGE

MONTEREY RANGER DISTRICT

Age Classes	Acres
0-10	222,361
11-20	0
21-30	5,850
31-40	3,680
41-50	4,165
51-over	90,240
Total District Acres	326,296

SANTA LUCIA RANGER DISTRICT

Age Classes	Acres
0-10	82,949
11-20	20,841
21-30	85,341
31-40	23,707
41-50	10,488
51-over	256,805
Total District Acres	480,132

SANTA BARBARA RANGER DISTRICT

Age Classes	Acres
0-10	24,901
11-20	61,801
21-30	57,191
31-40	2,847
41-50	39,958
51-over	125,495
Total District Acres	312,193

OJAI RANGER DISTRICT

Age Classes	Acres
0-10	23,912
11-20	2,263
21-30	23,623
31-40	0
41-50	183,707
51-over	101,750
Total District Acres	335,255

MT. PINOS RANGER DISTRICT

Age Classes	Acres
0-10	0
11-20	14,608
21-30	4,331
31-40	4,136
41-50	21,490
51-over	429,569
Total District Acres	474,134

LOS PADRES NATIONAL FOREST

Age Classes	Acreage	Percentage
0-10	354,123	18.4
11-20	99,513	5.2
21-30	176,336	9.1
31-40	34,370	1.8
41-50	259,808	13.4
51-over	1,003,859	52.1
Total Forest Acreage (within Forest boundary)	1,928,009	100.00
Actual Forest Acreage	1,964,408	
Error on Gross Acreage	.019	
	1.9%	

Average age class per acre = 44.3 years

TABLE 8a

EFFECT OF FUEL LOADING ON FIRE SIZE
Fires over 100 acres, 1960-1977 (Origin within Protection Boundary)

Fifty-seven human-caused statistical fires occurring within the protection boundary were plotted to ascertain the age of the vegetation surrounding the origin. A base year of 1911 (earliest records on file) was established for those fires that were shown as originating in unburned fuel.

DATE	NAME	SIZE	PREV. BURNED	BRUSH AGE CLASS	DATE	NAME	SIZE	PREV. BURNED	BRUSH AGE CLASS
06/02/60	Gilliam	405	1922	38	12/07/74	Mormon	144	1966	8
09/05/61	LaCarpa	140	1932	29	05/10/75	John	420	1932	43
10/03/61	Friis	2351	1951	10	08/24/75	Red Hill	225	1917	58
07/06/61	Cuesta	340	1922	39	08/24/75	Blanca	1100	1971	4
10/04/62	Sta Paula	1941	1922	40	06/29/75	Indians	310	Unbrnd	64
07/24/63	Frenchman	380	Unbrnd	52	09/26/75	Rattlesnake	1550	1953	22
07/22/63	Davy Brown	1100	Unbrnd	52	04/20/76	Nacimiento	155	1960	16
08/03/63	Navajo	225	1951	12	02/16/76	Shale	230	1917	59
03/07/64	Polo	585	1917	47	12/04/76	Canyon	240	1932	44
08/23/64	Sespe	356	1932	32	05/29/76	Indian	11100	1919	57
09/22/64	Coyote	67000	1924	40	12/10/77	Alms	720	Unbrnd	66
06/27/65	Adobe	508	1932	33	07/26/77	Sycamore	820	1923	54
04/16/66	Junction	237	Unbrnd	55	07/31/77	Cachuma	1850	Unbrnd	66
08/06/66	Avila	155	Unbrnd	55	06/25/78	Gate	119	1917	61
06/11/66	Wellman	93000	Unbrnd	55	09/25/78	Cozy Dell	910	1948	30
06/21/68	Jose	103	Unbrnd	57	09/01/79	Nacimiento	5371	Unbrnd	68
05/23/68	Robinson	500	1946	22	09/11/79	Red	1619	1951	28
03/03/68	Matau	113	Unbrnd	57	09/18/79	Eagle	4530	1955	24
05/12/70	Zaca	285	Unbrnd	59	10/27/79	Haney	256	Unbrnd	68
06/18/70	Twin Rocks	270	1953	17	12/06/80	Gusty	150	1932	48
09/27/70	Buckeye	44000	Unbrnd	50	07/27/80	Rainbow	570	1911	69
08/02/70	Poplar	1260	Unbrnd	59	08/28/80	Johnson	180	Unbrnd	69
08/01/70	Cowhead	172	Unbrnd	59	11/26/80	Lockwood	5680	Unbrnd	69
08/30/71	Blue	1850	1917	54	06/25/81	Gamboa	3797	Unbrnd	70
08/27/71	Santa Ynez	2010	1964	7	07/09/81	Gamboa II	208	Unbrnd	70
07/21/71	Jeepway	120	1964	7	08/29/81	Porter	130	1949	32
10/06/71	Romero	14538	1925	46	09/22/81	Rey	1620	Unbrnd	70
08/07/71	Squaw	165	1917	54	10/21/81	Gay	1490	1922	59
08/22/72	Bear	17150	1932	40					

Age Class Range	# Fires	% of Total	Cumulative %
0- 9 Yrs.	4	9.5	
10-19 Yrs.	4	9.5	19.0
20-29 Yrs.	5	7.1	26.2
30+ Yrs.	44	73.8	100.0

A. The average brush-age class of the area in proximity to origin of Class D and above fires, 1960-1977 was 41.4 years.

B. 8 of 10 fires over 100 acres, occurred in brush fields over 20 years of age.

C. Of the 15 fires that burned over 1,000 acres, only 3 occurred in brush fields less than 20 years old.

yes

From

Dulen, Erwin + Blecker (1975) "Santa Ynez Flood Prevention Project" Review Report LPNF Santa Barbara

TABLE NO. 27

SANTA YNEZ FLOOD PREVENTION PROJECT

Fire Statistics - Number of Fires
1950-70 Santa Ynez Watershed
Compared to Rest of Los Padres National Forest

Year	Santa Ynez				Rest of Forest				Total Forest		
	M.C.	Cum.Total	L.	Total	M.C.	Cum.Total	L.	Total	M.C.	L.	Total
1950	4	4		4	30	30	7	37	34	7	41
51	4	8		4	26	56		26	30		30
52	1	9		1	21	77	18	39	22	18	40
53	1	10		1	32	109	1	33	33	1	34
54	1	11		1	25	134	5	30	26	5	31
55	2	13		2	18	152		18	20		20
56	1	14		1	18	170	6	24	19	6	25
57	2	16		2	17	187	10	27	19	10	29
58	1	17	2	3	18	205	44	62	19	46	65
59	1	18		1	22	227	8	30	23	8	31
60	2	20		2	18	245	12	30	20	12	32
61	3	23		3	30	275	22	52	33	22	55
62	2	25		2	32	307	1	33	34	1	35
63	1	26		1	30	337	3	33	31	3	34
64	5	31		5	26	363	6	32	31	6	37
65	3	34	1	4	31	394	19	50	34	20	54
66	9	43		9	44	438	15	59	53	15	68
67	2	45	4	6	35	473	33	68	37	37	74
68	6	51		6	63	536	10	73	69	10	79
69	5	56		5	55	591	15	70	60	15	75
70	6	62		6	88	679	6	94	94	6	100
21 Yr. Total	62		7	69	679		241	920	741	248	989
30 Yr. Ave.	89		10	99	970		344	1314	1059	354	1413

M.C. = Man-caused fires
L. = Lightning fires

TABLE NO. 28

SANTA YNEZ FLOOD PREVENTION PROJECT

Number and Size Class of Statistical Fires Santa Ynez Watershed
Compared to Rest of Los Padres National Forest Calendar Year 1950-1970 (21 Year Period)

Santa Ynez Watershed
Number of Fires by Size Classes (235,570 acres)

Year	Class A	B	C	D	E	F	G	Sub-Total Santa Ynez
1950		1	1	1			1	4
1951	4							4
1952		1						1
1953		1						1
1954	1							1
1955		1			1			2
1956	1							1
1957	1	1						2
1958	3							3
1959	1							1
1960	2							2
1961	2			1				3
1962	2							2
1963		1						1
1964	2	2		1				5
1965	3			1				4
1966	4	2	2	1				9
1967	3	2			1			6
1968	4	1	1					6
1969	5							5
1970	3	2		1				6
Total	41	15	4	6	2	0	1	69
%	59.4	21.8	5.8	8.7	2.9	0	1.4	

Rest of Los Padres National Forest
Number of Fires by Size Classes (1,736,430 acres)

Year	Class A	B	C	D	E	F	G	Sub-Total Forest w/o S.Y.	Total Forest
1950	17	11	2		2	2	3	37	41
1951	5	5	5	5	3	2	1	26	30
1952	21	16	1	1				39	40
1953	16	7	5	3	1		1	33	34
1954	8	12	3	2	3	1	1	30	31
1955	3	7	4	2	1		*1	18	20
1956	13	7	3			1		24	25
1957	16	5	3		1	1	1	27	29
1958	43	12	6	1				62	65
1959	17	9	3		1			30	31
1960	16	5	5	1	2		1	30	32
1961	38	7	2	2	2	1		52	55
1962	24	4	4			1		33	35
1963	17	10	2	1	2	*1		33	34
1964	20	7	2		2		*1	32	37
1965	31	10	6		3			50	54
1966	40	8	7	1	1	1	*1	59	68
1967	43	15	7	1		1	1	68	74
1968	44	14	8	4	2	1		73	79
1969	42	16	11	1				70	75
1970	57	23	8	4		1	1	94	100
Total	531	210	97	29	26	14	13	920	989
%	57.8	22.8	10.5	3.2	2.8	1.5	1.4		

Fire Size Classes	Acres
A	0 - .25
B	.26 - 9.9
C	10.0 - 99.9
D	100.0 - 299.9
E	300 - 999.9
F	1000 - 4999.9
G	5000 +

(*) Fires which originated outside the Santa Ynez Drainage and burned into the Santa Ynez Drainage.

TABLE NO. 29

SANTA YNEZ FLOOD PREVENTION PROJECT

Fire Statistics - Burned Area (Acres) Santa Ynez Watershed
Compared to Rest of Los Padres National Forest Calendar Year 1950 - 1970 (21 Year Period)

	Santa Ynez Watershed (235,570 Acres)		Rest of Los Padres National Forest (1,736,430)		Total Los Padres National Forest (1,972,000 Acres)	
Year	Burned Acres Inside N.F. Protection Bndry.	Cumulative Burned Acres	Burned Acres Inside N.F. Protection Bndry.	Cumulative Burned Acres	Burned Acres Inside N.F. Protective Bndry.	Cumulative Burned Acres
1950	2,877	2,877	39,782	39,782	43,659	42,659
1951		2,877	21,143	60,925	21,143	63,802
1952	6	2,883	339	61,264	345	64,147
1953	3	2,886	31,111	92,375	31,114	95,261
1954		2,886	9,205	101,580	9,205	104,466
1955	11,693	14,579	55,549	157,129	67,242	171,708
1956		14,579	3,206	160,335	3,206	174,914
1957	1	14,580	19,170	179,505	19,171	194,085
1958		14,580	417	179,922	417	194,502
1959		14,580	678	180,600	678	195,180
1960		14,580	12,493	193,093	12,493	207,673
1961	140	14,720	2,824	195,917	2,964	210,637
1962		14,720	344	196,261	344	210,981
1963	15	14,735	1,729	197,990	1,744	212,725
1964	46,475	61,210	17,589	215,579	64,064	276,789
1965	225	61,435	852	216,431	1,077	277,866
1966	5,119	66,554	97,775	314,206	102,894	380,760
1967	7	66,561	3,549	317,755	3,556	384,316
1968	1	66,562	3,704	321,459	3,705	388,021
1969		66,562	470	321,929	470	388,491
1970	293	66,855	34,384	356,313	34,677	423,168
Total	66,855		356,313		423,168	

TABLE NO. 34

SANTA YNEZ FLOOD PREVENTION PROJECT

AVERAGE ANNUAL PERCENT BURN CALCULATIONS

Fire History - Calculation of average annual percent burn in the Santa Ynez Watershed compared to the rest of the Los Padres National Forest for the 21-year period 1920-1940 before the project and the 21 year period 1950-1970 with the project.

21-year Period	Santa Ynez (235,570 Ac)		Rest of Forest (1,736,430 Ac)		Total Forest (1,972,000 Ac)	
	Ac Burn	% Annual	Ac Burn	% Annual	Ac Burn	% Annual
1920-40	173,755	3.5	629,902	1.7	803,657	1.9
1950-70	66,855	1.35	356,313	.97	423,168	1.01

Calculations:

1920-40

$\frac{173,755}{235,570} = .7375 \div 21 = .0351$ or 3.5%

$\frac{629,902}{1,736,430} = .363 \div 21 = .0172$ or 1.7%

$\frac{803,657}{1,972,000} = .407 \div 21 = .0193$ or 1.9%

1950-70

$\frac{66,855}{235,570} = .2838 \div 21 = .0135$ or 1.35%

$\frac{356,313}{1,736,430} = .205 \div 21 = .0097$ or .97%

$\frac{423,168}{1,972,000} = .214 \div 21 = .0101$ or 1.01%

TABLE NO. 35

SANTA YNEZ FLOOD PREVENTION PROJECT

FIRE OCCURRENCE PROBABILITY CALCULATIONS

Projected number of man-caused and lightning fires for the 30-year period 1971 to 2000 is based on past fire occurrences and projected trends.

Average number of man-caused fires per year by five-year periods in the Santa Ynez Watershed compared to rest of Los Padres NF:

Five Year Period	Santa Ynez		Rest of Forest		Forest Total	
	No.	Av/Yr	No.	Av/Yr	No.	Av/Yr
1951-1955	9	1.8	122	24.4	131	26.2
1956-1960	7	1.4	93	18.6	100	20.0
1961-1965	14	2.8	149	29.8	163	32.6
1966-1970	28	5.6	285	57.0	313	62.6
Total	58		649		707	
Projected number of man-caused fires as per graph in Figure 16 page A-14.						
1971-1975	38	7.6	380	76.0	418	83.6
1976-1980	47	9.4	470	94.0	517	103.4
1981-1985	50	10.0	500	100.0	550	110.0
1986-1990	53	10.6	530	106.0	583	116.6
1991-1995	53	10.6	530	106.0	583	116.6
1996-2000	53	10.6	530	106.0	583	116.6
Total	294		2940		3234	
Total expected lightning fires	10		344		354	
Table 27 page A-1						
Total Fires 1971-2000	304		3284		3588	

TABLE 35 CONT.

The projected occurrence of man-caused fires is shown graphically in Figure 16 page A-14. The projected line is based on the assumption that the number of fires will continue to increase at about the same rate as shown in the five-year periods 1961-1965 and 1966-1970. Starting in 1980, it is assumed that recreation use within the Santa Ynez Watershed will level off due to regulation and control of public use and the number of fires will also level off correspondingly. Projections beyond 20 years are difficult, so it is assumed that there will be no increase or decrease in the last 10 year period 1991-2000.

The number of lightning fires is based on the 30-year average calculated from the 21-year period 1950-1970.

Number of large fires - Class F (1000 - 4999.9 acres) and Class G (5,000 acres or over) occurring per 100 fires over the 21-year period 1950-1970.

Area	Total Fires	Class F		Class G	
		Number	Rate/100	Number	Rate/100
Santa Ynez	69	0	-	1	1.45
Rest of Forest	920	14	1.52	13	1.41
Forest Total	989	14	1.42	14	1.42

Comparison by periods: Number of large fires per 100 fires
(Reference Table 28 page A-2)

Period	Years	Santa Ynez Class		Rest of Forest Class		Total Forest Class	
		F	G	F	G	F	G
1950-59	10	0	5.00	2.46	2.46	2.31	2.60
1960-70	11	0	0	1.17	.84	1.08	.78
1950-70	21	0	1.45	1.52	1.41	1.42	1.42

TABLE 35 CONT.

Projected number of large fires Class F and G per 100 fires for the 30-year period 1971-2000 is based on the average for the past 21-year period 1950-1970. The past 21-year period is used as an average since the difference between the first 10 and last 11 years appears to be large. A 10-year fire record does not appear to be a long enough period to make reliable projections in an area the size of the Santa Ynez Watershed.

$$\frac{\text{Projected No. of Fires}}{100} \times \text{Rate/100} = \text{No. of large fires/100}$$

Area	Class F (1000-5000 Ac)	Class G (5000 Ac+)	Expected Total F&G Year 1971-2000
Santa Ynez	See footnote(1)	$\frac{304}{100} \times 1.45 = 4.4$	5.4 (lowest likely level)
or			
Santa Ynez	$\frac{304}{100} \times 1.00 = 3.0$(2)	$\frac{304}{100} \times 1.45 = 4.4$	7.4 (highest estimate)
Rest of Forest	$\frac{3284}{100} \times 1.52 = 49.9$	$\frac{3284}{100} \times 1.41 = 46.3$	96.2 or 96
Total Forest	$\frac{3588}{100} \times 1.42 = 50.9$	$\frac{3589}{100} \times 1.42 = 51.0$	101.9 or 102
or			
Total Forest	52.9	51.0	103.9 or 104

(1) There was no occurrence of a Class F fire in the Santa Ynez during the 21-year period 1950-1970; however, it is expected that one could occur in the next 30-year period 1971-2000 by comparing the Forest total of 50.9 - 49.9 = 1.0.

(2) Assume that the number of Class F fires in the Santa Ynez even though lower than the rest of the Forest will occur at the rate of one per 100 fires. Since only 69 fires occurred in the previous 21-year period 1950-1970 it is likely that one class F fire could occur per 100.

Conclusion: There is a probability over the next 30-year period 1971-2000 that the projected burned area in the Santa Ynez Watershed will result from 5.4 large fires which is the lowest likely level or 7.4 large fires which is the highest estimate.

TABLE 12

Fire Management Analysis Zone	Location	Projected Fires/Year	Projected Acres Burned Annually	Acres Burned by 1980-1989 Decade
A Coastal Monterey	West of Coast Ridge or Ocean Front Streams	12.2	3063	30,630
B Interior Monterey	All Monterey R.D. east of Coast Ridge	10.1	1429	14,290
C Santa Lucia R.D.	All Santa Lucia R.D. north of Highway 166	6.5	2149	21,490
D Sisquoc River	Entire Sisquoc River mostly Santa Lucia R.D.	3.4	2320	23,200
E Santa Ynez	Entire Santa Ynez River drainage	7.5	4459	44,590
F Santa Barbara Front and Ojai Front (Casitas) (N.F. land)	All N.F. land south of Camino Cielo Ridge to Forest Bndry. east to Santa Barbara/Ventura County line	2.7	489	4,890
G Santa Barbara/Ojai Fronts (Private)	Same as above	13.0	753	7,530
H Ojai Front east to Piru Creek	Includes Ojai Front, Lower Sespe, Lower Piru, Santa Paula and Hopper Units	6.6	7348	73,480
I Matilija-Sespe-Upper Piru-Ventura drainages	Same as FMAZ's description	6.2	1887	18,870
J Cuyama Front & Upper Cuyama	Sierra Madre forms south boundary of area	5.6	1127	11,270
K Badlands	Area bordered by Hwy. 33 on west, by Mt. Abel Rd. on north, by Lockwood/ Ozena Rd. on south, & by timber on the east	3.3	15	150
L Timber Tops	Alamo Mtn., Frazier Mtn., Mt. Pinos, Mt. Abel	7.1	8	80
M Northeast Corner (F.S.)	Tecuya Ridge, Lockwood Valley, Frazier Park, portions of Upper Piru	5.8	244	2,440
N Northeast Corner (Private)	Same as above	4.2	196	1,960

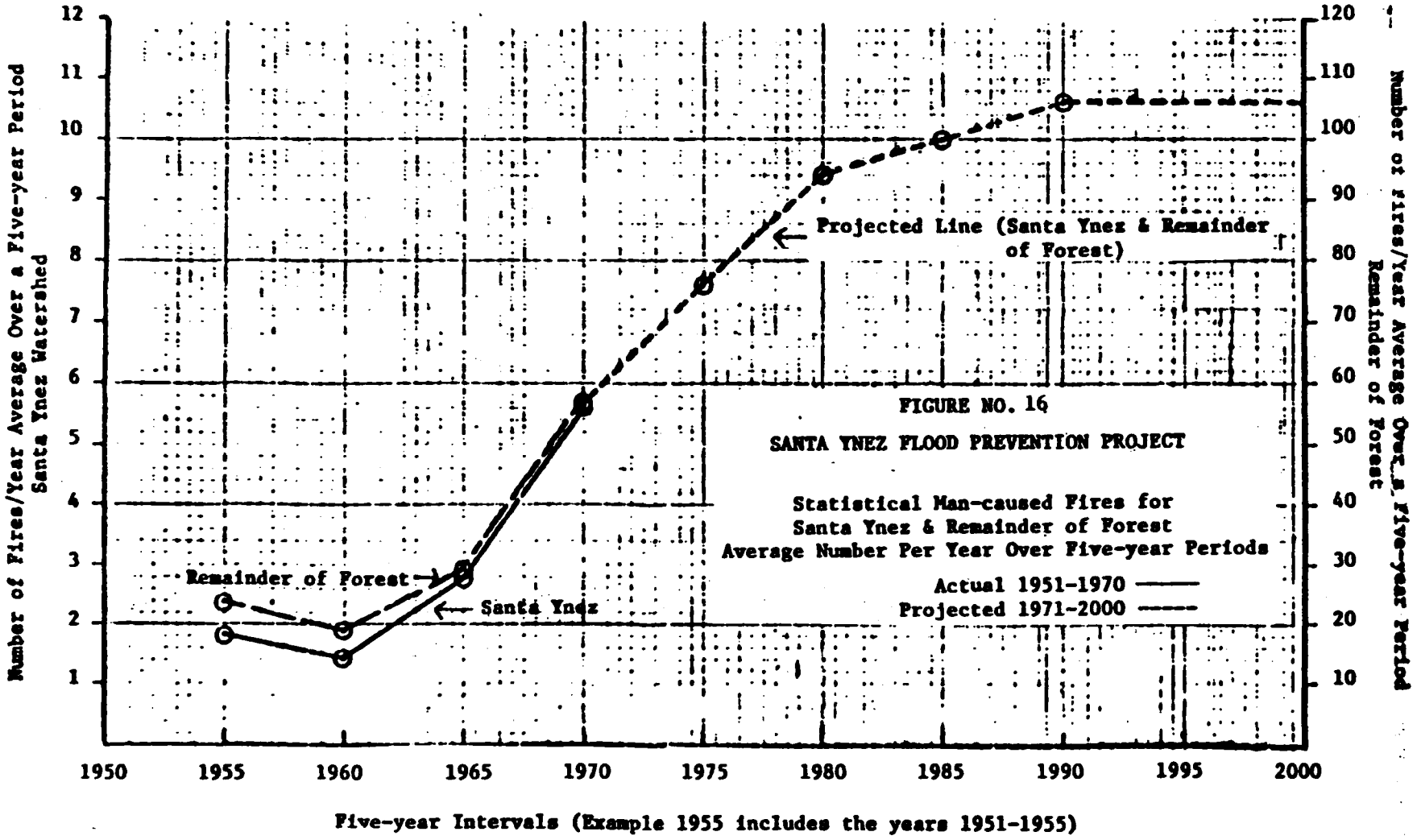
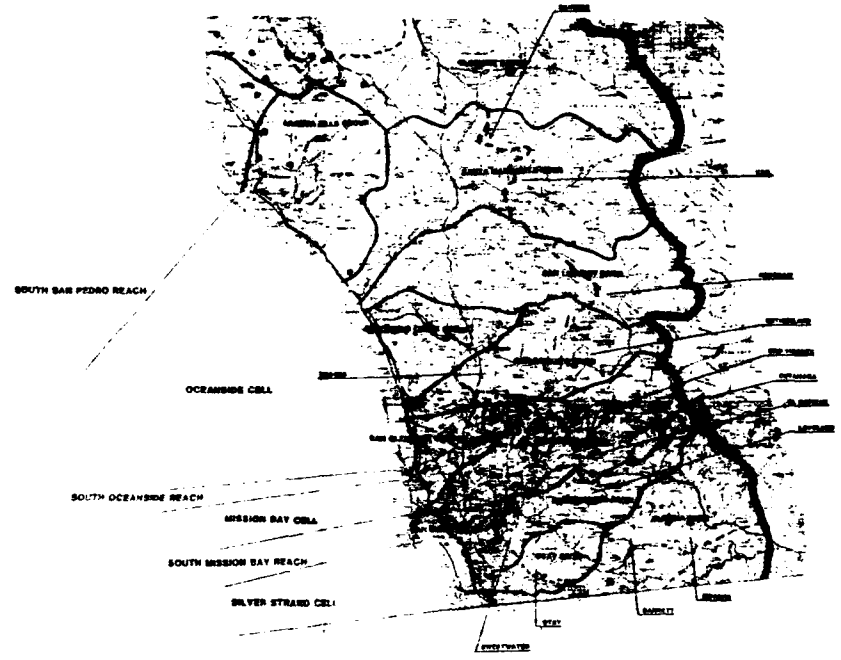


FIGURE NO. 16

SANTA YNEZ FLOOD PREVENTION PROJECT



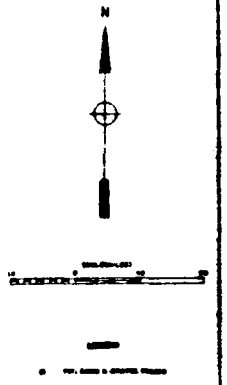


PLATE 2.1 SAN DIEGO REGION

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY (CCSTWS)

LOS ANGELES DISTRICT BOUNDARIES - CALIFORNIA COASTLINE FROM THE MEXICAN BORDER TO RABBIT POINT

PREPARED FOR LOS ANGELES DISTRICT CORPS OF ENGINEERS

WATERSHED AND LITTORAL CELL BOUNDARIES AND MAJOR CONTROL STRUCTURE LOCATIONS

CONSULTING ENGINEERS

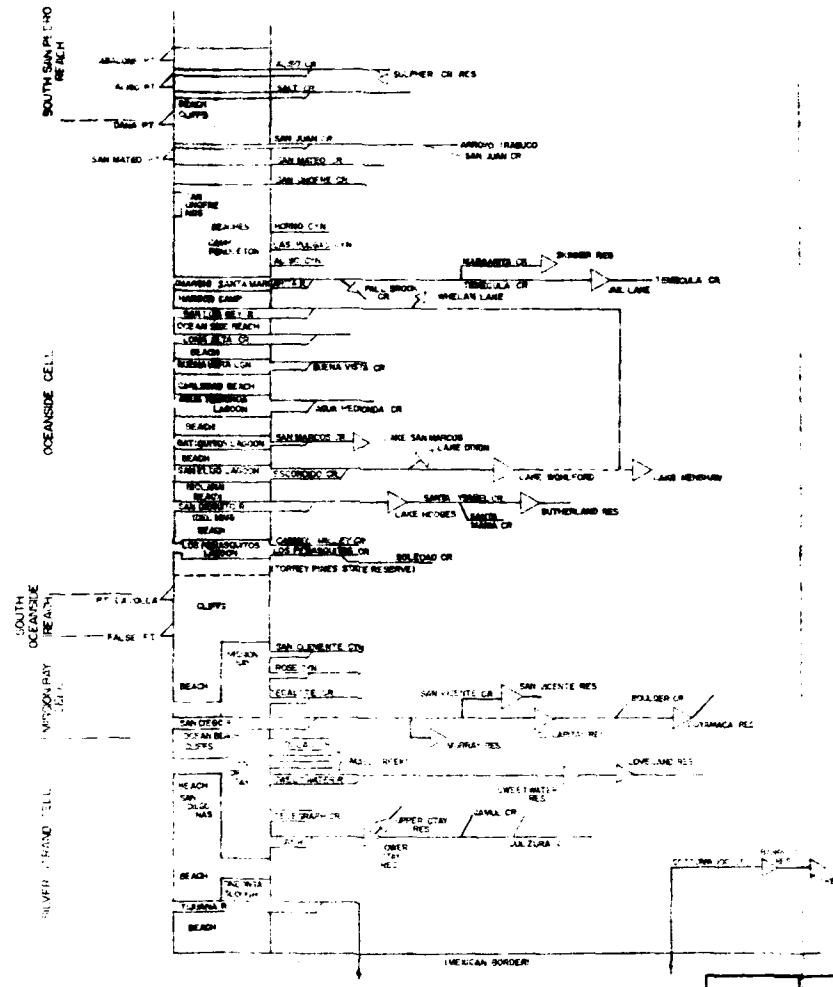


PLATE 2.2 SAN DIEGO REGION

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY (CCSTWS)

LOS ANGELES DISTRICT BOUNDARIES - CALIFORNIA COASTLINE FROM THE MEXICAN BORDER TO RAGGED POINT

PREPARED FOR LOS ANGELES DISTRICT CORPS OF ENGINEERS

CONSULTING ENGINEER

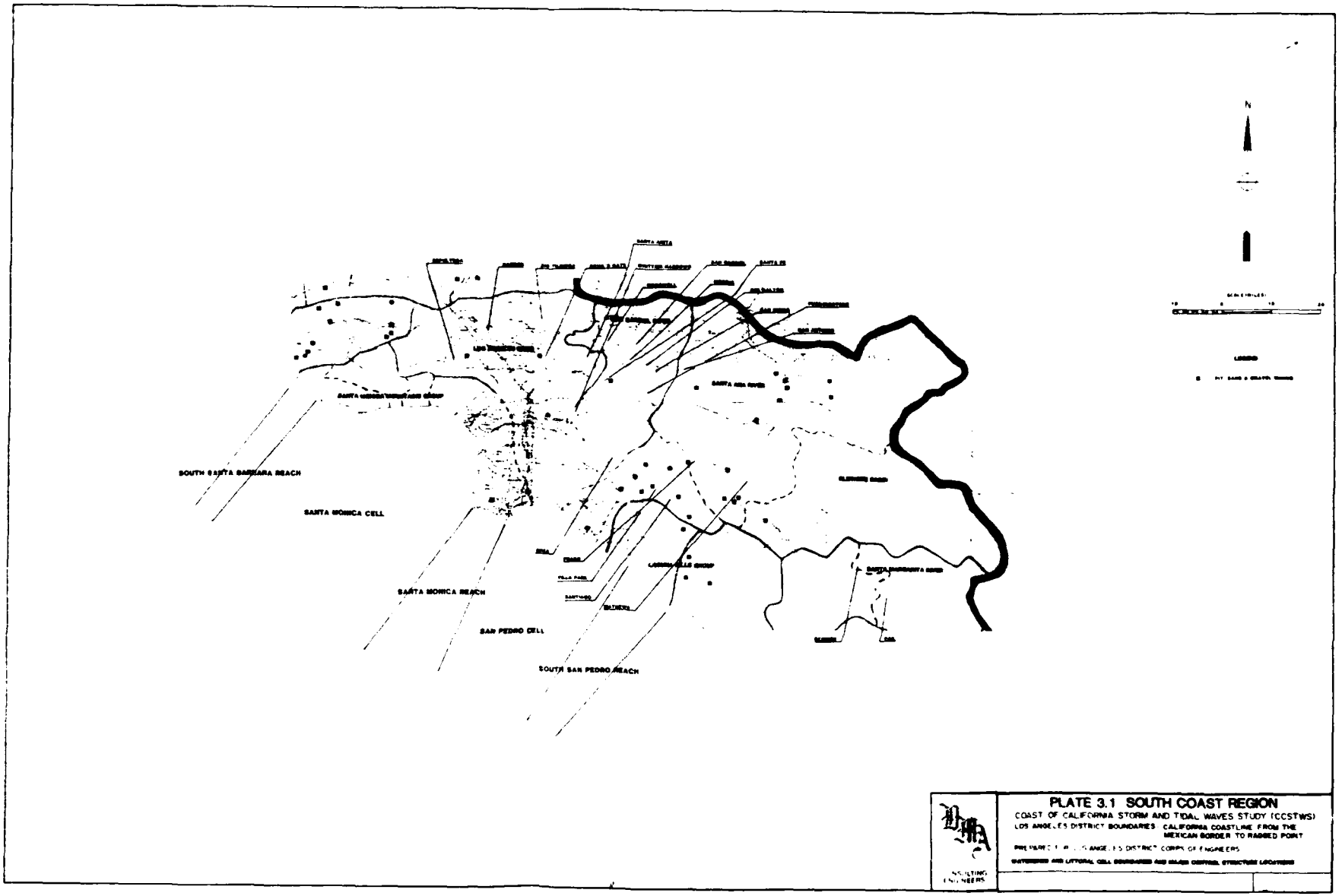


PLATE 3.1 SOUTH COAST REGION

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY (CCSTWS)

LOS ANGELES DISTRICT BOUNDARIES CALIFORNIA COASTLINE FROM THE MEXICAN BORDER TO RABBIT POINT

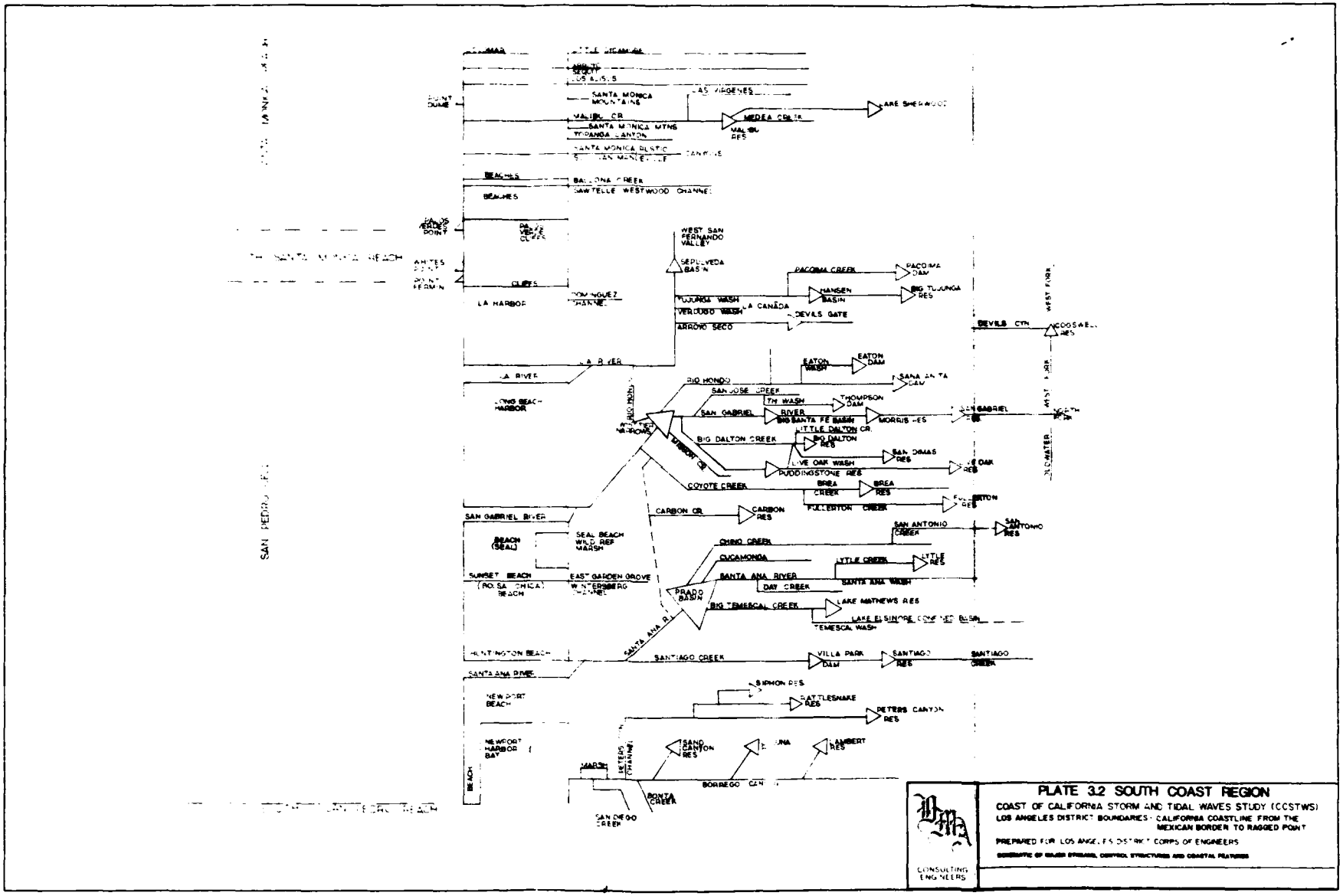


PLATE 3.2 SOUTH COAST REGION

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY (CCSTWS)

LOS ANGELES DISTRICT BOUNDARIES - CALIFORNIA COASTLINE FROM THE MEXICAN BORDER TO RAGGED POINT

PREPARED FOR LOS ANGELES DISTRICT CORPS OF ENGINEERS

BY BARNARD OF INLAND STREAMS, CONTROL STRUCTURES AND COASTAL FEATURES

CONSULTING ENGINEERS

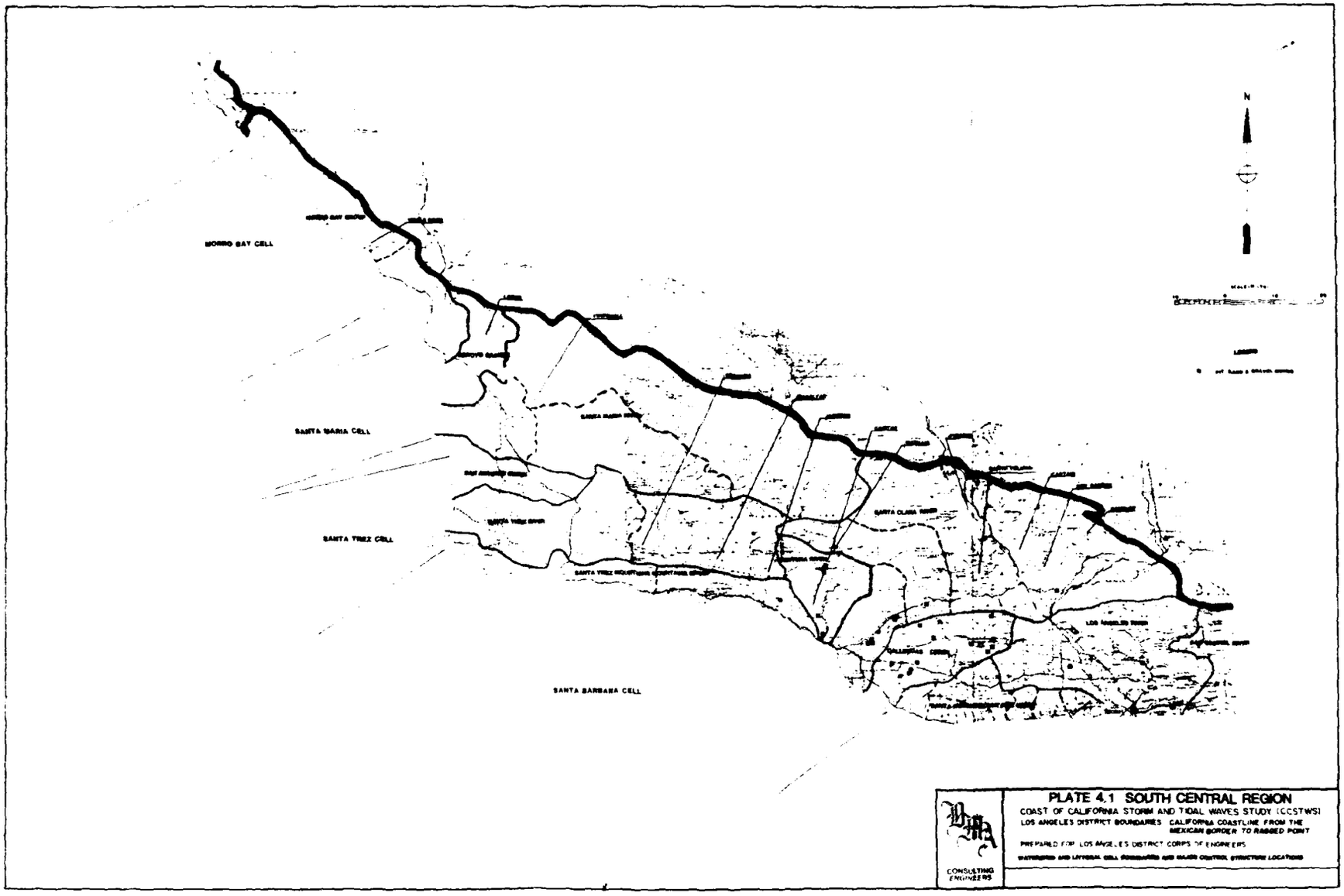


PLATE 4.1 SOUTH CENTRAL REGION

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY (CCSTWS)

LOS ANGELES DISTRICT BOUNDARIES CALIFORNIA COASTLINE FROM THE MEXICAN BORDER TO RAGGED POINT

PREPARED FOR LOS ANGELES DISTRICT CORPS OF ENGINEERS

WATERSHED AND LITTORAL CELL BOUNDARIES AND MAJOR CONTROL STRUCTURE LOCATIONS

CONSULTING ENGINEERS

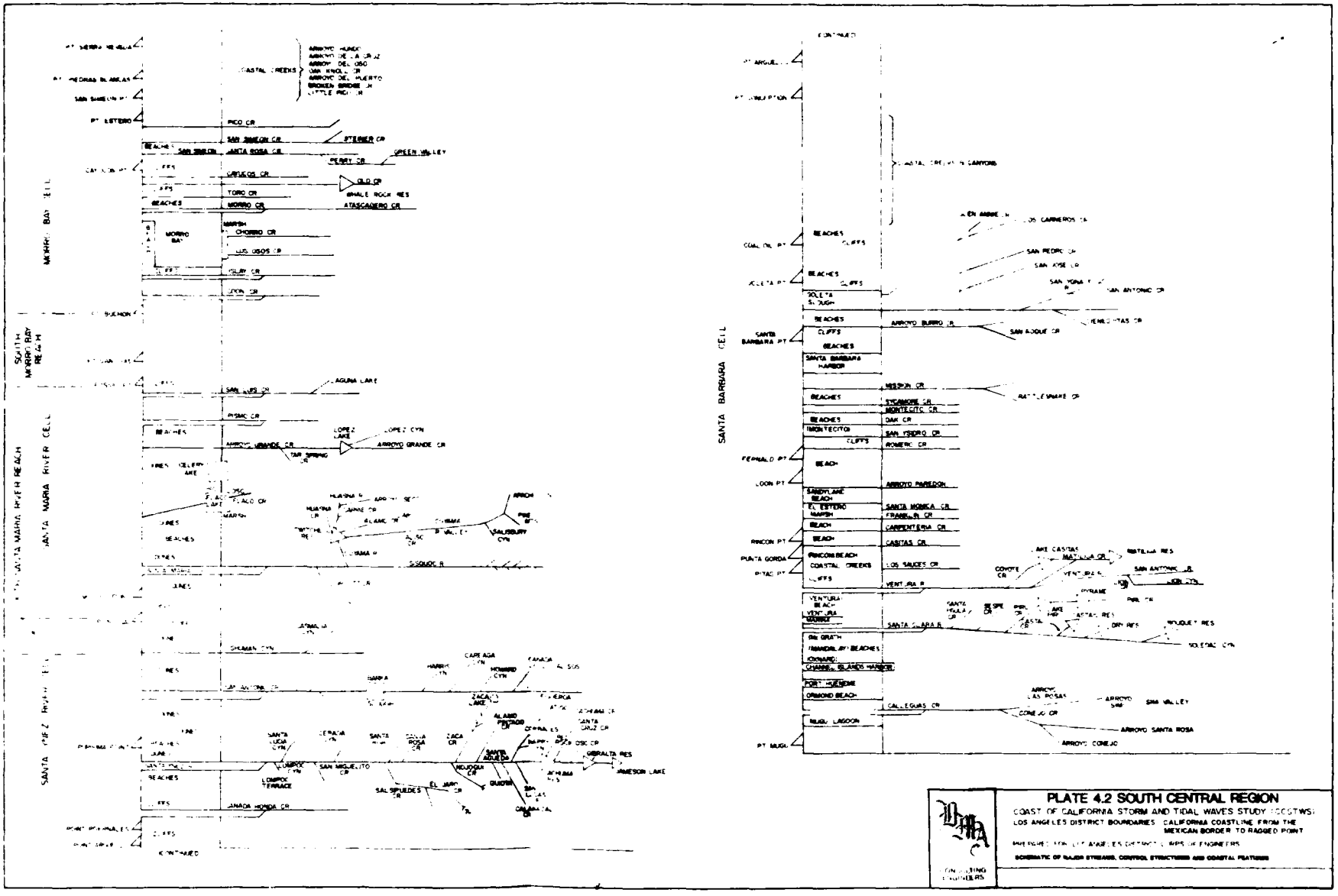


PLATE 4.2 SOUTH CENTRAL REGION

COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY (CCSTWS)

LOS ANGELES DISTRICT BOUNDARIES CALIFORNIA COASTLINE FROM THE MEXICAN BORDER TO RAGGED POINT

SCHEMATIC OF MAJOR STREAMS, CONTROL STRUCTURES AND COASTAL FEATURES

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